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1936

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Silicate Cements—*Swanson*
Arthritis—*Finkle*
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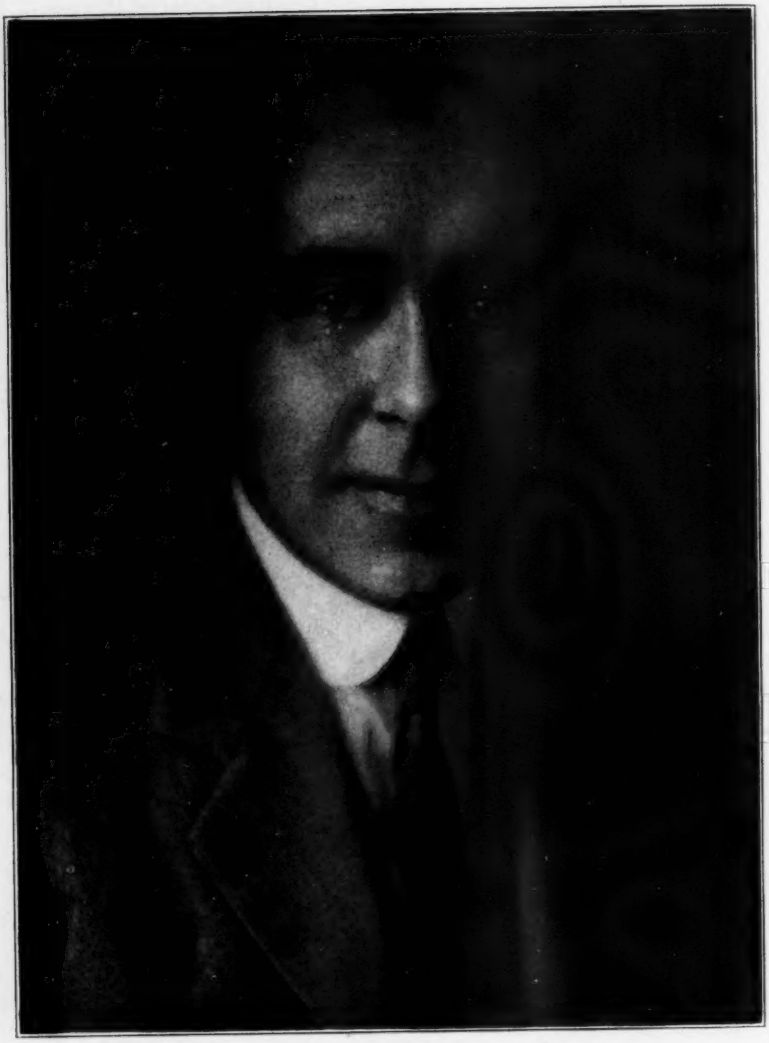

C. WILLARD CAMALIER, D.D.S., Washington, D. C.
President Elect of the American Dental Association

THE JOURNAL
of the AMERICAN DENTAL ASSOCIATION

Vol. 23 SEPTEMBER, 1936 No. 9

Original Communications

PRESIDENT'S ADDRESS*

By GEORGE B. WINTER, D.D.S., St. Louis, Mo.

A SURVEY of the past and present—of the dangers confronting the organized dental profession and its present accomplishments—should be exact. A preview of the future cannot be so definite; for who may foretell the advancement to be made or the opportunities lost, in the years to come? We are on the threshold of a period when success or failure will have far-reaching consequences, and the fate of dentistry and medicine is in the balance. One thing we do know, and that is that while history is in the making, it is not for the American Dental Association to sit on the side lines after the manner of listless spectators. We must be not only among those present, but also among those participating in the struggle and guiding the destiny of our profession.

ECONOMIC PROBLEMS

The outstanding trend in national and world affairs today is toward the establishment of economic dictatorships. A means by which economic dictators may grow in power and strengthen their position is our already-existing civic, professional and social institutions. Civic and social groups have as their chief object advancing the welfare and interests of their members. The support of those which are not extremely altruistic can often be gained by subsidies. If it is impractical to buy them outright, they may be complimented by recognition and personal appeals from high quarters, and their favor won in this way.

Professional organizations have as their aim the unselfish promotion of public welfare. Chief among such groups are, of course, the American Medical Association and the American Dental Association. Of what advances may have been made to the first-mentioned group, I am not in a position to speak, but there seems to be good reason to fear that any agreement that might be reached between an economic dictatorship in this country and medicine would not be under the

*Read at the First General Meeting of the Seventy-Eighth Annual Session of the American Dental Association, San Francisco, Calif., July 14, 1936.

auspices of its leading professional organization, whose motives are beyond reproach. The politicians would probably affiliate with exploiters, who are not acceptable to their professional organization, and who would be found docile.

As to whether there has been any attempt at a tie-up between organized dentistry and a plan for economic control, I can definitely answer no. Organized dentistry is prepared to furnish able and unselfish leadership in any plans and efforts that may be made to deal with problems involving dental health. There is no need to seek elsewhere. Furthermore, there is no need for organized dentistry to make any compromises with sound principles. We need not sell out to political power.

It has been suggested that a plan of insurance practice might be established by the government, guaranteeing each dentist a certain amount of practice, for which he would be paid by the government. Certain questions naturally arise concerning such a plan. Who would administer it—organized dentistry, or a political appointee who might not be acceptable to organized dentistry? What rights would the dentist be asked to surrender or what compromises would he be asked to make in return for the guaranteed income? which could be but small. What change would be made in those fine relations between doctor and patient which have been established? What benefits over the present system would the citizen secure in return for the tax or levy against his income which such a state practice would make necessary?

The members of our profession need make no compromise with their conscience in order to gain a livelihood. We have within our own organization men who are making a careful and intelligent study of our economic and social problems as well as our professional problems. I have confidence in their ability to find a solution and to apply it. Our Association has shown steady progress and our present outlook is bright with promise for its continuation. We shall have to fight for it, perhaps even harder than we now anticipate. Our success depends on whether the intelligence of our citizens is such that they will reject plausible but false promises, and on the degree of selfishness of our politicians. It is to be hoped that regard for their own self-interest may possibly cause them to stop before they have gone too far.

But, however difficult the struggle may be, we have the intelligence, initiative and strength to carry it to a successful conclusion and to fulfil our obligations to safeguard dental health. Of this our history and our present situation give us reason to feel assured. It would be a dangerous self-assurance that did not recognize the true situation and take steps to shape its outcome. Against such assurance, I wish to warn you most earnestly. We must guard against emotional appeal, false promises and illusions.

COMMITTEE ON ECONOMICS

The Committee on Economics is one of the most active of the American Dental Association. Thirteen district members and forty-eight state deputies keep in touch with economic conditions and transmit information to the Central Office. A press clipping bureau also collects information on general economic conditions for the committee.

The committee transmits its information to the profession through THE JOURNAL and monthly releases to the dental press. During the past year, THE JOURNAL gave 60 pages to the subject of dental economics, while approximately 18 pages of mimeographed press releases have been sent each month to editors of state and component societies.

In addition, the committee is engaged in making three important surveys. One is to develop a list of all practicing dentists in the United States; another, to collect information on requirements for American dentists to practice in foreign countries; the third, to secure additional information on health insurance and state dentistry in foreign countries. The committee has already compiled a wealth of material showing the harmful results of state medicine and compulsory health insurance. The value of this work in combating its spread is shown by the fact that 600 copies of the data compiled have been sent on request to high school and college debating teams, besides those sent to members.

COMMITTEE ON NOMENCLATURE

There are a great many activities of the American Dental Association of which members are not taking full advantage. I think it fitting at this time to call attention to the fine work done by the Committee on Nomenclature.

This committee, since its appointment under its present chairmanship in 1922, has issued reports suggesting improvements in nomenclature. An important work of the committee was the issuing of a book on dental nomenclature fashioned after the Basle Anatomical Nomenclature, with the purpose of aiding in the coinage and formation of new, needed terms. This book was distributed free to members on request, until an edition of 600 copies was exhausted.

The suggestions and recommendations made by the committee from time to time have been well received. It is to be regretted that apparently a great many of the members of our profession know nothing of this important committee and of the work that it is doing. In general, specialists have cordially welcomed and adopted the recommendations of the committee, but this is not true in the field of periodontia. For this reason, the nomenclature of the periodontists is still confused. It is my hope that the important work of this committee may become more widely known and utilized.

LIBRARY BUREAU

I wish, too, that our membership in general might be better informed on the services that the Library Bureau of our association can render them. For example, it has legal information which will assist them to testify as experts in damage suits growing out of accidents or suits for malpractice. Those who have been involved in court action of any kind can appreciate the value of being able to obtain for themselves or their lawyers the best information available.

It furnishes material for postgraduate work or study in special fields, and for writing papers or books and giving clinics. One member, while physically incapacitated, achieved important professional advancement as a result of studying more than a hundred books borrowed from the library.

Our library, though not large, is outstanding for its service, as testified to by a newspaper information service bureau, which was able to secure from it immediately the facts that a search of three days in the Library of Congress had not located; and the recommendation of a foreign dentist that his society expand its library along the lines of ours, after he had been furnished with the research material that he was seeking.

NATIONAL BOARD OF DENTAL EXAMINERS

The National Board of Dental Examiners is a major educational activity of the American Dental Association. Its importance is shown by the fact that more than 450 have participated in its examinations, that study groups have

been formed to prepare for them and that eleven states accept its certificate of certification. I wish that the facts about this activity might be more generally known.

The American Dental Association is not attempting through this board to grant licenses or interfere with the right of state boards to grant licenses. The national board gives a comprehensive examination based on changing educational requirements. As students from more than 60 per cent of our colleges have participated, the results enable schools to determine the effect of their teaching and judge their curriculums in comparison with those of other schools.

States have the privilege of accepting or rejecting with or without further examination an applicant who has passed the examination, and if the certificate has been accepted for theoretical work, the candidate is always required to take a practical examination. The ethics of candidates is safeguarded by the fact that no dentist in practice is accepted unless his conduct is vouched for by his own state board and local or state society.

DENTAL EDUCATION

Education is the foundation of the dental profession and on it depends dentistry's progress. It is a noteworthy fact that achievements in dentistry have run parallel with rising standards of dental education, which two surveys have been important factors in bringing about. The first, the Carnegie Survey of Dental Education, was a very constructive piece of work, furthering the development of a broader view and clearer understanding of the obligations and responsibilities of dentistry and dental education.

In collaboration with the representative of the Carnegie Survey, William J. Gies, the Dental Educational Council of America made an inspection of all dental schools for the purpose of classification. The council took the position that instruction in dental schools should be of as high quality as that in universities and that all dental schools should have university affiliations. Immediate and continuous improvement in dental education followed these innovations.

The other important survey was made by the Curriculum Survey Committee of the American Association of Dental Schools, which was appointed in 1930 to determine what should be taught as a foundation for instruction in dentistry, in view of oral health needs and the responsibilities of the profession. Grants by the Carnegie Corporation to support this study have to date totaled $45,000.

The committee was composed of forty teachers in dental schools and two university deans, with two dental educators as advisors and a full-time executive secretary. More than 100 other teachers reviewed the work of the committee, which, in April, 1935, published an extensive report entitled "A Course of Study in Dentistry." This report outlines a course of study to serve as a foundation for general dental practice. It summarizes the oral health conditions of the people, analyzes the responsibilities of dentistry, states the objectives of undergraduate dental education and sets forth, in considerable detail, the knowledge, skill and experience which the student should acquire. It also contains a statement regarding the student's preliminary college education.

Before this survey, there was no complete statement regarding the material that should make up the subjects taught to undergraduate dental students. This was a serious handicap to educators and examiners. The survey is of vital importance to all interested in dental education or predental training. It has been favorably received and widely used not

only in the United States, but also in foreign countries.

The committee is now engaged in a study of methods of teaching dentistry and is planning to present an extensive report on methods and procedures, with definite application to the problems of teaching in dental schools.

During this period of economic upheaval and financial uncertainty, dental schools, like other educational institutions, have suffered a material loss in income. Nevertheless, these institutions have in general maintained high standards of instruction. This has been accomplished only because of the loyalty of instructors, who have made many personal sacrifices. Their salaries have been materially reduced and they have been required to work longer hours and carry a heavier load of teaching. The good work they have done under such conditions should receive the commendation of all members of the profession.

It has been my privilege to be associated with dental schools for many years and to see the advancement being made in dental education. My observation over this period, and particularly during my official connection with the American Dental Association, convinces me that organized dentistry should encourage and support dental education to the fullest extent, for this is the surest way to succeed in our efforts in research and scientific advancement, and to insure the preservation of the present status of our profession. Education is essential for any profession, and the recognition accorded dentistry by other professions will depend on the excellence and effectiveness of its educational program.

ORGANIZATION ACTIVITIES

The time devoted by the officers, committees, and members of the various state and local societies, as well as of the national body, to preparing programs, looking after legislative and economic problems and otherwise furthering the activities of their organization is indicative of an interest in associational welfare that gives one a feeling of security, since it makes for a strong organization and one that can be relied on to deal with any important issues. Legislative matters are now of great importance, and our profession is fortunate in not having such cults to deal with as those that offer resistance to the efforts of medicine toward desirable legislation.

Last year as President Elect and this year as President, I visited as many organizations as I possibly could. The cordiality of the reception accorded me and the interest in our national organization have greatly impressed me. The spirit shown by the local bodies I consider an indication of the desirability of more frequent personal contact with them by officials of the American Dental Association. It is important for us to cooperate in every way possible with our component societies.

Enlarging certain of our activities, as was done in the case of the committees on legislation and economics, is very desirable. By this means, we have secured the assistance of able workers in many states who are experts in these fields. What they have already accomplished is evidence that the policy is a workable one and advantageous to the organization.

As an official of the American Dental Association, I have been in a position to study at close range the many plans which have been proposed for social changes in connection with dental practice. I have had an opportunity to see the fine work accomplished by our standing committees in checking or modifying legislation that would not be workable or to the best interests of the public or the profession.

The committees engaged in the vital, serious struggle to resist the encroachment of socialized health insurance have had the confidence of the Officers and Trustees of the American Dental Association. If, as last year, they enjoy the confidence of the House of Delegates, they will have every encouragement to continue their important work.

I should like to take this opportunity to pay tribute to the rank and file of our membership. These members faithfully devote their best efforts to the practice of dentistry so that each one is our profession's duly constituted representative to that section of the public with which he comes in contact. The financial and moral support which they give makes possible our great organization. Even though they may not render committee service or seek office, it is the confidence of their unanimous, whole-hearted and enthusiastic support that has made possible whatever has been accomplished in my administration. It is for this reason that I wish to render tribute to them and acknowledge our indebtedness.

COMMUNITY ORAL PROBLEMS

By a campaign whose effectiveness has been in keeping with the earnest efforts of the organizations conducting it, much has been done to decrease the prevalence of tuberculosis, and now similar campaigns have been inaugurated to stamp out venereal diseases. It would appear that the time is opportune for the dental profession to inaugurate a campaign to check the prevalence of the many ills that have their origin in the oral cavity. There is a better understanding today of how the teeth of the expectant mother can be conserved and of the value of certain foods for the proper formation and the preservation of the teeth. Information concerning these important matters should be even more widely disseminated.

A report that should be widely read has been issued by the Committee on Community Dental Service of the New York Tuberculosis and Health Association, showing the importance and value of cooperation between the medical and the dental professions. One example of this is shown in an examination of the registered blood donors in the City of New York to determine their dental condition. The committee found that the percentage of blood donors with dental disease or uncleanliness was high and that the percentage of those who gave their teeth daily care was low. The most significant and important conclusion reached is that no person with a diseased mouth should be eligible to act as a blood donor. Many of the blood donors examined had mouth conditions that were not only detrimental to their own health, but also hazardous to the recipients. Recipients have, of course, lowered resistance to disease, and there is a possibility of secondary infection as a result of the transfusion of blood from an infected person. It was decided that it was unwise to risk exposing the recipient to such infection.

A change in the rules and regulations governing the health standards of donors was recommended by the committee. It is desired that similar research be carried out in other cities, which should be to the advantage of the dental and the medical profession and of benefit to the public health.

The press quotes the editor of the *Journal of the American Medical Association* as follows: "Our annual medical bill is three billion six hundred fifty million dollars per year and the dental expenditure is four billion dollars per year, most of which is spent on toothpastes and mouthwashes."

I earnestly recommend that the public consider its expenditures for dentifrices and mouthwashes in the same class with

its expenditures for cosmetics, for which it is estimated that two billion dollars was spent last year. The purchase of a tooth paste, tooth powder or mouth wash is no more an investment in dental care than the purchase of a cake of soap is an investment in medical treatment. True, cleanliness is necessary for health, and a social service has been performed by the advertisers of cleansing agencies in educating the public regarding this fact.

CONSEQUENCES OF DENTAL NEGLECT

The neglect of the teeth, the failure to appreciate the importance of dental care and the consequences of this neglect were never shown more strikingly than in an informal report on conditions in the C.C.C. camps, made by a dental reserve officer who is sincerely concerned about the situation that he found when called on to give emergency treatment to men enrolled in the service. The only treatment provided for is extraction and sealing medicaments in a cavity and applying them to gum tissue. The dentist's conscience revolted at the thought that no better provision was made for the care of men who had from six to twenty-eight badly decayed teeth and serious dental infection.

The avowed aim of these camps is not only to provide work so that the self-respect of the enlisted men does not suffer, as it sometimes does from their being entered on relief rolls, but also to prepare the workers to return to their communities better able to play an independent, self-respecting part in community life. With this in view, educational programs have been prepared. One is moved to question the value of some of the items included in the programs, such as oil painting or tap dancing, for men suffering from acute oral infection or abscessed teeth. There is reason to believe that the pain and general impairment of health and morale caused by such conditions may be directly responsible for the person's being incapable of self-support.

There is need for a program of dental hygiene in every community to guard against the development of such conditions. Any provision made to care for the socially inadequate should seek to correct the cause of their status. To deal with the conditions now existing in C.C.C. camps, provision for more adequate treatment by local dentists is essential, with the assistance of the dental reserve corps members when necessary.

Our profession is coming to realize that proper appreciation of dental needs and the inclusion of dentistry in public health and social security plans are not to be attained for the asking. United effort, with each member of the profession assisting his local society, and the local societies cooperating with the national body, is the only means by which our profession can gain proper recognition and reach a solution of dental health problems.

PUBLICITY

Although dentistry receives but scant attention from the press as a rule, it is noteworthy that one of the big news stories of the year was the announcement that a dentist had discovered a means for preventing pain during the preparation of dental cavities.

It is the earnest wish of the profession that the public learn the facts about dental pain and the efforts being made to relieve it. Fortunate indeed are the persons in our own generation who have access to the benefits of modern civilization. One of the most important is the opportunity to have that commonest of operations, the removal of teeth, performed with the use of anesthetics; not to mention the skilful technic by which it is now possible to lengthen the period of useful-

ness of teeth. Repair of the teeth is accomplished with a minimum of discomfort to the patient, and progress toward eliminating even this is constant.

There is reason to believe that the profession has gained through the public's having learned from this publicity something of dentistry's efforts to eliminate pain, even though overstatements aroused expectations that could not be fulfilled. This, of course, is to be regretted. It was but natural that overstatements should appear in announcements of a matter of great public interest on which the public has but little information.

The development of an anesthetic that is effective for every patient has yet to be achieved. The announcement of such a development should be given first to the dental profession, by whom it would be more enthusiastically received than by the general public as it would facilitate the practice of dentistry, bringing in more patients and assuring ease in treating them; since fear of pain keeps many people from seeking treatment until acute conditions develop. Such neglect is dangerous to the general health and makes for the maximum of discomfort when treatment is finally secured.

Medicine has suffered far more than dentistry from the sensational announcement of cures. Some have been without foundation and some partially true, as the publicizing of insulin as an actual cure for diabetes, when, instead, it enables the sufferer to lead an almost normal life in spite of the continued presence of his ailment.

Such announcements put the profession on the defensive. They cannot be ignored, because we are obligated to render an account of how we are fulfilling our important trust in giving the best possible dental care.

There is a lesson for the general public, the press and the profession in the excitement caused by the announcement that the pain of dental work had been eliminated, a statement followed later by disillusionment. We hope that it may lead the general public and the press to look to our organization for the facts about developments in dentistry. The Association is earnest in its efforts to obtain the facts, to foster research and to apply its findings.

The lesson that the profession should have learned from this experience is that more publicity of the right kind is needed in order to promote dental health. The public needs to know the facts so that it will take proper precautions and seek treatment in time. The way to accomplish this is to seek a closer affiliation with the press.

Nothing would afford me greater satisfaction than to be able to assist in furthering desirable relations between our profession and the press. The public needs facts, not fantasy. The press should see that it is to its interest in attempting to serve the public to establish a closer relationship with such an outstanding professional body as the American Dental Association, the largest and most representative organization of its kind in the world. Seventy per cent of American dentists are members. Our organization has in its possession a vast fund of information which is not only newsworthy, but also from which the public could profit.

To further public health, the American Dental Association will welcome any opportunity to cooperate with the press, the radio and motion picture organizations. We recognize the great power which these agencies have to promote human welfare, and hope that they will recognize the disinterestedness of our desire to cooperate with them to determine how much can thereby be accomplished in public health education. The source or

clearing house for news about dental matters should be the American Dental Association, in view of the great fund of specialized information in this field possessed by our members, and the unselfishness of our efforts to serve the public. We wish to give the public only the facts, and to do it in such a way that they cannot be misunderstood or misinterpreted. It is cruel for expectations to be aroused, only to be shattered because they are based on a misunderstanding. We should like to guard against this occurring again in connection with dental matters.

DENTAL HEALTH EDUCATION

We have made a good start in public health education through programs in many progressive school systems instructing pupils in dental care. In this way, health habits are established and any dread of the dental chair which the attitude of elders might cause is overcome.

There is cause for the profession to feel serious concern about the small amount of recognition accorded dental care in public health plans. A survey by the U. S. Public Health Service determined that only fourteen states have provided for the appointment of dentists on state boards of health; only five state boards employ full-time dentists; one state board employs a part-time dentist; three state boards employ hygienists, and two employ teachers. Of those large cities which include dental care in their health department programs, very few are concerned with problems of public health administration. Rather, their attention is given to clinics for school children.

There is evidence of a lack of public interest in dental health, and this is clearly the result of a lack of knowledge as to its importance. No health program can be complete that does not make ample provision for dental health education.

SOCIAL SECURITY ACT

A sum of $8,000,000 has been appropriated under the Social Security Act to the United States Public Health Service. It is to be used to assist states and political subdivisions of states to establish and maintain health services, including the training of personnel. What is aimed at is a nation-wide program for public health, aided by the Federal Government, but supported and conducted, as far as possible, by the states and local communities. An additional $8,150,000 has been appropriated for maternal and child health, and $2,000,000 to the United States Public Health Service, to be used for research on various diseases. It is worthy of note that no specific mention of dentistry is made in the act, in spite of the work accomplished by our profession, its admitted importance and the fact that dentistry should play a part in any health service, any child and maternal welfare program and any plan for research into disease. Dentistry has not won the recognition that is its due.

In spite of this, dentistry may play a part in developing and carrying out the proposed work. It is right that it should, because dental disease can be as subversive of efficiency and happiness, and as surely fatal as many of the physical ailments that have their seat elsewhere in the body. That dentistry may play its part, state dental societies must consult with their state health officer, with the aim of cooperating in establishing a dental health division in the state department of health. Only by the recommendation of the state officer can any dental health project have funds allocated to it. As conditions in different communities vary, it is well that local societies plan these projects, for, in this way, the program best fitted to the local situation may be developed.

The American Dental Association is prepared to help the societies in this work and earnestly desires to do so. At our meeting at New Orleans last year, evidence was given of this attitude, in the appointment of a standing committee on public health to initiate or promote dental health activities in state, city, and local governments. I know that progress is being made in many states toward this end and I wish that every one in attendance at this meeting might gain from it a heightened interest, if nothing else, in public health matters and a desire to do his utmost to promote public dental health activities in his community, whether independently or under the Social Security Act.

The provisions of the act are such that existing local health agencies are encouraged to try to solve their own problems in the way best suited to local conditions and are given an opportunity to plan and direct the program. The most should be made of this opportunity, in order that there may be no excuse for criticism or for the initiation of plans looking to the taking over of these matters by any centralized agency. Such a central body might have difficulty in keeping in touch with or understanding situations in each of the forty-eight states. It would be undesirable because of the ease with which it might be controlled by selfish interests; if for no other reason. Here is an opportunity for dentistry to render public service and to secure public recognition. Let each one of us feel himself individually responsible for making the most of it. The United States Public Health Service is doing valuable work. Let us learn more about it and help our communities to benefit from it. Full information can be secured from the Service. The American Dental Association also has valuable material to contribute, and its staff, officers and committee members welcome consultation.

DR. MESSNER

I should like to take this occasion to pay sincere personal tribute, as well as tribute on behalf of our profession, to the memory of my very good friend, Clinton T. Messner. His devotion to the public interest and to our profession lives on in the plans that he developed for the participation of dentistry in the public health program. His work in the United States Bureau of Public Health has been the means of our accomplishing much more in public health service and in gaining greater recognition than ever before. Our profession is greatly indebted to him. In his sudden and untimely death shortly before this meeting, our profession and the American Dental Association have suffered a great loss. He had done much for our organization and we expected to ask yet more of him. Dentistry's participation in the program of the United States Public Health Service was the plan nearest his heart. As a tribute to him, let us devote our best efforts to carrying out his wishes by cooperating in the program that he initiated. He was not allowed time to do more than develop the plans and start the work. The plans are indeed well laid and a fine start has been made. It is for us to continue the work to the fulfillment that he so greatly desired.

SICKNESS INSURANCE PLANS

It is possible that some time within the coming year a campaign may be started to revive the sickness insurance plan. It will be necessary for the medical and the dental professions to be prepared to meet this situation by using the utmost effort and all of the resources at their command. In order that our profession may do its part, a publicity campaign conducted

from the Central Office in Chicago should be inaugurated as soon as possible. As a side issue to a possible campaign combating state dentistry, we have the educational program teaching the public the benefits of mouth hygiene conducted by the Bureau of Public Relations. Now appears to be the time for the initiation of a determined effort of this kind, that we may be prepared to deal with a situation which may confront us in the future.

There must be many members who have ideas and plans to suggest which would be for the betterment of the dental profession. They should not hesitate to present them, and such plans should be welcomed and carefully considered. As many as are found to be practical should be put into effect as soon as possible.

CONCLUSION

As I have been identified with the scientific side of our profession for a great many years, it has been a mental change to study the economic, legislative and other social problems of dentistry. On retirement from office, I shall return to my original interest, scientific matters, with increased knowledge from participation in the many worth-while, constructive programs carried out by our organization.

I wish to express my appreciation to the officers and members of our great organization for the help and cooperation which they have given me during my administration. I have been given not only all of the assistance I requested, but volunteer service for which I had no right to ask. Continuity in carrying on the work of this office was assured by the assistance which my predecessor, Frank M. Casto, gave to facilitate my assuming the office of President and to lighten my tasks. A successful administration during the coming year is insured by the interest and grasp of the situation shown by my successor, Leroy M. S. Miner.

I can assure you that every one of our officers and committee members has worked with me in an able, self-sacrificing manner to give all of the assistance which he possibly could to advance the best interests of our profession and organization. Not one member whom I have called on for help has failed to give capable and whole-hearted assistance. The help given my administration by our Central Office has also been most able. Words, however much they come from the heart, are not adequate to express the sincere appreciation which such cooperation must necessarily inspire. I can only say that for whatever I have been able to accomplish, credit is due you.

EFFECT OF PARTICLE SIZE ON THE PHYSICAL PROPERTIES OF SILICATE CEMENTS*

By EDGAR W. SWANSON, D.D.S., M.S.D., Chicago, Ill.

REVIEW OF THE LITERATURE

ALTHOUGH one finds some reference in the literature to particle size in connection with zinc phosphate cements, no reference whatever has been found in the case of silicate cements. There have been some articles on silicate cements which deal with matters that might depend somewhat on particle size.

Crowell[1] probably presents the most recent and reliable information on the chemistry of silicate cements:

> Silicate cements differ from zinc phosphate cements chiefly in the composition of the powder. The liquids are solutions of phosphoric acid partially neutralized with zinc oxid and alumina, differing from the zinc cement liquids only in the amount of water contained.
>
> The powders are complex acid soluble glasses. Their constitution is unknown. When acted on by acids, silicic acid is liberated, but the base to which it was attached in the glass is difficult to determine. In our opinion, it is alumina. When a large amount of alumina is present, the powder is quick setting. Reducing the quantity retards the set.

Ray[2] states that:

> When the powder and liquid are mixed, the acid of the liquid attacks a part of the powder, forming colloidal aluminum phosphate and colloidal silicic acid. This reaction proceeds very slowly on a cold slab, but speeds up considerably when the mass is warmed. After a certain amount of the silicic acid has been formed and the acidity of the liquid has been decreased, the silicic acid gels, or partly sets. The reaction of the residual phosphoric acid and the incorporated powder continues for some time, the hardness and strength of the cement increasing accordingly. In no case does all of the liquid and powder react completely. During the reaction, the acidity of the liquid decreases and finally becomes so low that the reaction practically stops.

In order to produce a silicate filling of maximum excellence, this chemical action must be consummated within a time sufficient to allow insertion of the filling into a cavity without entirely too long a period of holding it in place while setting. Silicic acid gel, once broken, does not, according to Crowell,[1] grow together again. This is probably one of the main causes of failure of silicate fillings. If Crowell is correct in this, particle size could very well be an important factor, because the chemical action of the liquid on fine particles will be much more rapid than on the larger ones.

Voelker[3] reports that all popular silicate cements are soluble to some extent in distilled water; and that, on the addition of 1 per cent solution of lactic acid, the solubility was increased approxi-

*Read before the Section on Operative Dentistry at the Seventy-Second Annual Midwinter Clinic of the Chicago Dental Society, Feb. 18, 1936.

1. Crowell, W. S.: Physical Chemistry of Dental Cements, J.A.D.A., 14:1030-1048 (June) 1927.

2. Ray, K. W.: Behavior of Silicious Cements, J.A.D.A., 21:237-251 (Feb.) 1934.

3. Voelker, C. C.: Dental Silicate Cements in Theory and Practice, D. Cosmos, 58:1098-1111 (Oct.) 1916.

mately twice. More recently, Mathews[4] carried out a series of experiments that substantiated Voelker's work.

SEPARATION OF PARTICLES

White powder containing no pigment was used. An analysis of this material is as follows:

Silica (SiO_2)	39.9 per cent
Fluorine (F_2)	15.4 per cent
Alumina (Al_2O_3)	27.7 per cent
Phosphate (P_2O_5)	4.0 per cent
Calcium (Ca)	5.9 per cent
Sodium (Na)	6.6 per cent
Moisture Loss	0.5 per cent

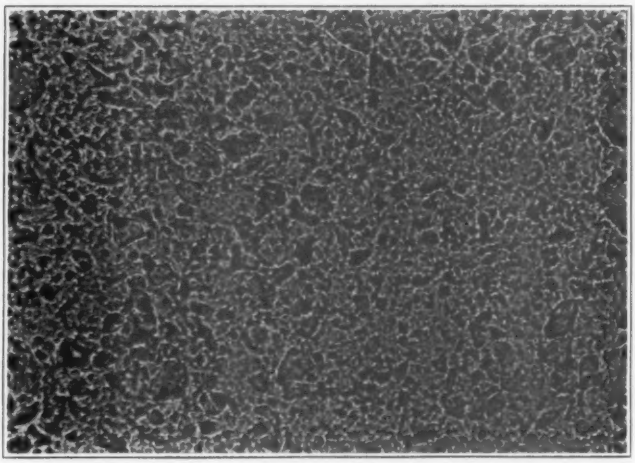

Fig. 1.—Particle distribution in "original" silicate powder. (×330.)

In order that a line of demarcation between the fine, medium and large particles could be made, the particles were accurately measured and counted in several fields of a specimen of the silicate powder, on a slide under a microscope. The number and size of the particles are shown in Table 1.

4. Mathews, Ernest: Some Observations on Silicate Cements, Brit. D. J., 56:431-439 (May 1) 1934.

All the particles with a diameter of less than 4 microns were classified as fine; those of between 4 and 12 microns, as medium, and those of over 12 microns, as large.

Hereafter, the fine particles will be designated as Group I, the medium sizes as Group II and the large sizes as Group III, or simply as I, II and III. The original powder will be designated as "original."

Table 2 shows the number of particles counted in each group as calculated from Table 1. The third column represents their distribution of occurrence on a percentage basis.

Separation of the particles was accomplished by application of the principle that the larger the diameter of the particle, the more rapid its fall in a viscous liquid. After much tedious experimentation, it was decided to separate the particles in a solution of 10 c.c. of glycerin to 100 c.c. of distilled water.

A special glass tube with a stopcock

at the bottom was made, and markings of the levels of 30 c.c., 60 c.c. and 90 c.c. were made on the side of the tube. The distance from the stopcock to the 30 c.c. level was 75 mm.; to the 60 c.c. level, 112 mm., and to the 90 c.c. level, 150 mm.

Approximately 1.5 gm. of the powder was put in the tube containing 60 c.c. of the water-glycerin solution and thoroughly shaken for two minutes. It was then set in a clamp on a ring stand and allowed to settle for two minutes, when about 3 c.c. was drawn off into a beaker. This was largely III. More of the solution was added to bring it to the 60 c.c. mark (112 mm.), and it was thoroughly shaken again and allowed to settle for two minutes. Then another 3 c.c. was drawn off into the beaker. The tube was filled to the 60 c.c. level again and shaken as before, and the liquid was allowed to settle for two minutes (third time). Now the tube was taken out of the clamp and the liquid carefully decanted into another beaker, the settled powder being left on the side of the tube. This was washed down into the first beaker as it was principally III. The decanted portion was mainly I and II. This was repeated for a fourth time. There was now one beaker containing principally I and II, and one beaker, principally III.

The beaker containing I and II was poured into the clean tube, and the tube was filled to 90 c.c. (150 mm.), shaken, and set in the clamp, and the liquid allowed to settle for twelve minutes. About 75 c.c. was decanted, which was I in suspension, the remainder being mainly II.

The contents of the other beaker, which was principally III, were poured into the clean tube, and the latter was filled to 90 c.c. (150 mm.) and shaken, and the liquid allowed to settle for twelve minutes. As much of the liquid as possible was decanted into a beaker. This was principally I. The settled por-

Table 1.—Particle Distribution

Under 4 microns,	120
5 to 8 microns,	54
9 to 12 microns,	28
13 to 16 microns,	18
17 to 20 microns,	11
21 to 24 microns,	4
25 to 28 microns,	3
29 to 32 microns,	2
60 microns,	1

Table 2.—Number of Particles in Each Group; Relative Distribution

Group	No. of Particles	Relative Distribution Per Cent
I	120	50
II	82	34
III	39	16

Table 3.—Setting Time in Relation to Particle Size

Powder	Relative Humidity Per Cent	Powder Gm.	Liquid C.c.	Mixing Time Min.	Time in Desiccator Min.	Set Min.	Set Sec.
Original	65	0.65	0.2	1	2	3	38
III	66	0.65	0.2	1	2	4	5
II	66	0.65	0.2	1	2	3	5
I	66	0.65	0.2	1	2	2	5
I	66	0.55	0.2	1	2	2	45

tion was principally III, and was washed into a separate beaker.

This process was repeated for some time until several beakers of each of Group I, II and III had been collected. Frequently, the liquid was poured off after the powder had settled on the bottom of the beaker; and the beaker was filled with distilled water and stirred to partially dissolve out the glycerin.

The next problem was to remove the glycerin and dry the powder. This was done by putting a small amount of the settled powder, with distilled water, in centrifuge tubes, each plainly marked, I, II and III and shaking and putting it in the centrifuge for three minutes. They were then removed, the liquid was decanted and the tubes were filled with distilled water again, stirred, and put back in the centrifuge for three minutes. This was repeated twice, alcohol being used for the fourth washing. The tubes were then put in a drier to evaporate the alcohol and water.

The acrolein test was then made for the presence of glycerin, and none was found.

The particle distribution of the "original" silicate powder is shown in the photomicrograph in Figure 1. Specimens of the separated powders obtained from the preceding method of separation are shown in the photomicrograph in Figures 2, 3 and 4.

TABLE 4.—RELATION BETWEEN CRUSHING STRENGTH AND PARTICLE SIZE

Powder	Crushing Strength* Lb./In.²
Original	8,558
III	4,790
II	10,327
I	9,604

*Average of five trials.

TABLE 5.—EFFECT OF PARTICLE SIZE ON PENETRATION AND SHRINKAGE

Specimen	Degree of Penetration	Relative Shrinkage
Original	Slight	Slight
III	Considerable	Considerable
II	Slight (plus)	Slight (plus)
I	Practically none	Practically none

MIXING TECHNIC

The nature of the tests to be performed on specimens required, of course, that the mixing technic be absolutely uniform and that it be carried out under uniform conditions. To insure this uniformity, special apparatus and equipment were provided.

TABLE 6.—EFFECT OF PARTICLE SIZE ON TRANSLUCENCE

Specimen	Degree of Translucency
Original	Greatest
III	Slightly less
II	Less
I	Least

In order to maintain a constant relative humidity, a special case was constructed (Fig. 5) and all mixes were made therein at a relative humidity of 65 per cent.

A 1 c.c. tuberculin syringe was used to measure out a definite amount of liquid for each mix and put in the case. The glass slab was cooled to 70 F. and thoroughly dried, and a weighed amount of the powder was placed on one end. A stopwatch was beside the case to time each mix accurately. When everything was in readiness, and the case closed, the hands were powdered and put into the gloves. A measured amount of liquid was put out on the other end of the slab and the powder was divided into a one-fourth portion, another one-fourth por-

tion and a half portion, with a stellate spatula. The first fourth of the powder was drawn into the liquid and spatulated for fifteen seconds; then the second fourth was drawn in and spatulated for another fifteen seconds, and finally the half portion was added and spatulated for thirty seconds; one minute in all being required. About two-thirds the area of a 3 by 6 inch glass slab was used in spatulating, and care was taken to see that all the powder was incorporated in each mix, which, for all the following tests, was made in this manner and under these conditions.

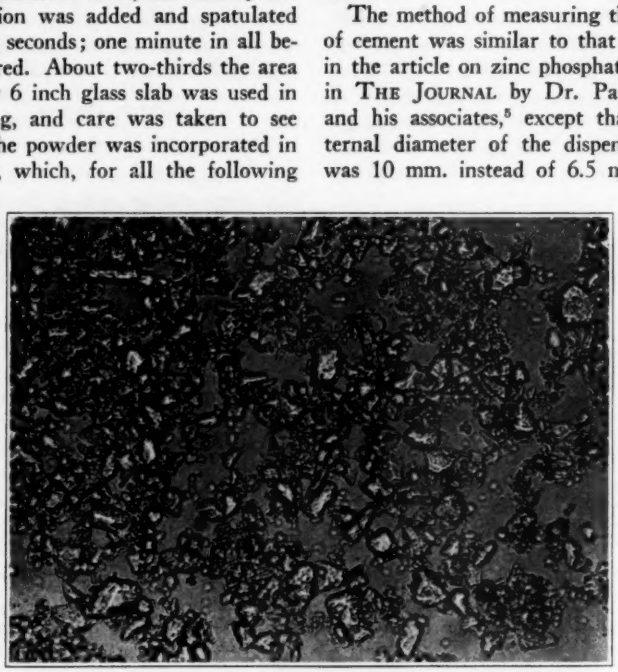

Fig. 2.—Specimen of large particles (III). (×330.)

CONSISTENCY

The consistency of the mixes was determined by methods similar to those suggested by the American Dental Association Research Associates at the New Orleans Session. Enough powder was incorporated in 0.4 c.c. of liquid to make a mix of which 0.5 c.c. would flow to an average diameter of 25±1 mm., eight minutes after spatulation, between two small glass plates under a weight of 2500 gm. placed two minutes after the beginning of the mix. The original powder as purchased was used for this experiment.

The method of measuring the 0.5 c.c. of cement was similar to that suggested in the article on zinc phosphate cements in THE JOURNAL by Dr. Paffenbarger and his associates,[5] except that the internal diameter of the dispensing tube was 10 mm. instead of 6.5 mm. Two small glass plates were put in the case, one weighing 24.4 gm., which was the one to be placed on top of the mix. Weights totaling 2475.6 gm. were then put in one corner of the case, together with the glass tube mold. Various amounts of powder were then weighed out and mixed as described, and the 0.5

5. Paffenbarger, G. C.; Sweeney, W. T., and Isaacs, Aaron: Zinc Phosphate Cements: Physical Properties and Specification, J.A.D.A., 21:1907-1924 (Nov.) 1934.

c.c. mold was filled and pushed out onto one of the glass plates.

At the end of two minutes from the start of mixing, the other glass plate was laid on the cement and the weights placed on top for eight minutes. The case was then opened and the greatest and smallest diameters were measured.

It was found that mixing 1.3 gm. of the powder with 0.4 c.c. of the liquid gave the proper consistency.

As a comparison of the effect of particle size was the main purpose of this work, the same consistency was used for all powders in all the experiments, except the one for setting time.

Fig. 3.—Specimen of medium particles (II). (×330.)

SETTING TIME

In every-day practice, the silicate cement is mixed at room temperature and sets in a cavity in a tooth at a temperature approximating 98.6 F. and a relative humidity near saturation, or 100 per cent. To reproduce this condition, an apparatus[6] similar to that described by Paffenbarger and his associates was used.

To conserve the powder that had been separated, one half the amount of powder and liquid was used, and the same ratio as determined in the preceding consistency test was maintained. Instead of using 1.3 gm. of powder, 0.65 gm. was used; and 0.2 c.c. of liquid instead of 0.4 c.c. Two specimens of each of the four powders were made as previously described and placed on a small glass plate, which was then placed on the desiccating tray, two minutes after the beginning of spatulation. Then a 1-pound Gilmore needle, the end of which was one-twenty-fourth inch in diameter, was inserted through the flap and set on the cement several times until its own weight made no imprint. The setting time was determined as the time elapsing

6. Paffenbarger, G. C.; Sweeney, W. T., and Isaacs, Aaron: Preliminary Report on Zinc Phosphate Cements, J.A.D.A., 20:1960-1982 (Nov.) 1933.

from the start of mixing, until the Gilmore needle made no impression on the mixed cement. The setting times for different mixes are shown in Table 3.

One can readily conclude that the finer particles set more quickly, which is in agreement with the chemical theory of setting cements, as more of the surface of the powder is exposed to the liquid.[1] Decreasing the ratio of powder will lengthen the setting time.

It is very evident that the setting time of the finer particles would be too short for practical use in the mouth, and that of the larger particles too long, while that of the medium is best. This factor could be controlled for practical needs by using less powder to a given amount of liquid or by the addition of a buffer to the liquid. It is interesting to note that the medium specimen did not have the same setting time as the original.

One would presume, then, from the fact that there are approximately three times the number of fine particles as large ones present in the original specimens, that the latter specimen would set faster than the medium specimen. As this is not true, evidently the large particles exert the greater influence on the setting time. The average of the setting times of the fine, medium and large particle size specimens is three minutes and five seconds, which is the same as the medium, but is thirty-three seconds faster than the original. This again seems to indicate the predominating influence of the large particles in a mix of silicate cement.

Fig. 4.—Specimen of fine particles (I). (×330.)

CRUSHING STRENGTH

The fact that the fine particles set before the cement could be satisfactorily sealed in a mold may mean that the rapidly forming gel was disturbed during this process. Therefore, for a study of crushing strength and all other properties of the four mixes, the conditions were exactly as in the experiments on setting time, except that the consistency was changed to a ratio of 1.1 gm. of powder to 0.4 c.c. of liquid. Five hard

rubber cylindrical molds, which the cement does not corrode, were made, 12 mm. high and 6 mm. in diameter. The inside of the cylinders was painted with a saturated solution of hard inlay wax in benzene, to facilitate removal of the specimens. One of the molds was set on a small glass plate lubricated with cocoa butter, and the mold slightly overfilled with the cement. A second small glass plate, also lubricated with cocoa butter, was placed over it and, at the end of two minutes, squeezed down to remove excess cement. Three minutes after the mix was started, the mold was placed in the desiccator with an atmosphere of 100 per cent relative humidity, and a temperature of 37 C., for three hours. Five specimens of each of the four powders were used.

Fig. 5.—Case in which all mixes for testing were made.

At the end of three hours, the molds with specimens were removed from the desiccator and put in a beaker of warm water. The ends of each mold were planed flat by drawing them back and forth and rotating them a quarter turn over a plate glass on which some carborundum powder (200 mesh) and water were placed. The specimens were then removed from the molds and the ends tested by a micrometer to see that they were flat and parallel, and then put in a flask of distilled water for seven days at room temperature.

They were then centered on the crushing block of an Emery testing machine, screw action, hydraulic recording, range 0 to 1,200 pounds. A small piece of wet blotting paper was placed on each end of the specimen to take up any minute irregularities.. The crushing head was moved by hand at the rate of 0.25 mm. per minute, and the point of crushing of each specimen noted.

The results are shown in Table 4.

These data show that the medium particles make the strongest cement, the

fine particles the next, the original the next and the large the weakest. The fact that the specimens made with the fine particles did not have the greatest crushing strength suggested the possibility that the gel, in that case, might have been disturbed because of the rapid time of setting for the fine particles. As they were in the mold and undisturbed approximately one minute before the mix was set, and the percentage of deviation between trials was no greater than with the medium specimens, it was concluded that the results were correct.

It is very evident that the large particles are the weakening element in the silicate cement, and it seems that the large particles in the original cement have a greater influence on the crushing strength than the fine particles. The cements made from the fine and medium particles were both stronger than the original, and the average of the two was about 1,500 pounds more than the original. As a contrast, the cement made from the larger particles was about 45 per cent weaker than the original. An average of the crushing strength of the fine, medium and large particles is 8,240 pounds per square inch, only 318 pounds less than that of the original cement. From these data, it may be easily deduced that the presence of large particles reduces the crushing strength in a ratio greater than their proportion.

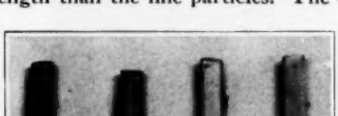

Fig. 6.—Degree of penetration of dye solution in specimens of III, II, original and I.

It may be further noted that the difference in crushing strength between the small and the medium size particles is very slight. In fact, it might be concluded that the influence of decreasing particle size on crushing strength reaches a limiting value with the medium particles, beyond which reduction in particle size has little effect.

It is then apparent that the medium particles are the most desirable, from the point of view of crushing strength, and the possibility of an optimum particle size is suggested.

PENETRATION AND DIMENSIONAL CHANGE

Two mixes of each of the four powders were made, as in the preceding experiment. After the one minute mixing time, the cement was packed into a small piece of glass tubing approximately 10 mm. long and 3 mm. internal diameter, by the end of two minutes. The ends were then painted with varnish and, after the latter had dried, the tube was set in a dish in the desiccating tray in approximately three minutes from the time of the beginning of the mix. The specimens were allowed to remain in the desiccator for three hours at a temperature of 37 C., and 100 per cent relative humidity.

The specimens were then removed and put in a beaker of water of the same temperature and allowed to cool at room temperature. During this time, the varnish was removed and the ends were carefully ground smooth by a fine emery wheel mounted in a handpiece, held under the water.

After being immersed in a solution of methylene blue and water for seven days, the specimens were removed from the dye solution and examined for shrinkage. The presence of dye between the cement and the inside of the tube showed that the specimens shrank. The large (III) specimens showed the most shrinkage, being loose in the tube and completely discolored by the dye. The

medium (II) were also completely discolored, but were fairly secure in the tube. The original specimens had several small areas that were not discolored; which shows that contact with the sides had been maintained. Some effort was necessary to remove it from the tube. The fine (I) specimens showed the least shrinkage. Approximately one-half its area was not discolored, and more effort was necessary to remove it from the tube.

Each specimen was then ground in half lengthwise and examined for penetration of the dye solution into the cements.

The amount of penetration of the dye solution into the specimens made from the large particles, medium particles, original, and fine particles (left to right) are shown in Figure 6. The specimen to the left, which was III, showed the greatest penetration; a good deal less was shown in II; very little was shown in the original, and practically none was shown in I. There is no stain on most of the right side of the last specimen (I); which showed that impregnable contact was maintained with the side of the glass tube at that point.

The results are shown in Table 5.

It is interesting here to note the same relative merits of the particle sizes as to penetration and shrinkage, the large particles being the poorest element and the fine particles the best. The large particles do not seem to be so important a factor in penetration and shrinkage as they were in the crushing strength and setting time, for the original does not allow much penetration or shrinkage.

As the fine particles had the least shrinkage, they probably offset the shrinkage of the large particles, for the medium size particles gave very nearly the same shrinkage as the original. This seems to indicate that, as the large particles have less surface exposed to the reaction, less gel was formed, which might tend to render the cement porous. Furthermore, since there was less surface exposed with the large particles, the binding power of the gel was less effective, because the points of adhesion between the surfaces of the particles are less. This effect is analogous to conditions in dental porcelains.

TRANSLUCENCY

Four slides were prepared in the following manner: a sheet of baseplate wax of uniform thickness, approximately 1 mm., in which a hole 1 cm. in diameter was cut, was sealed on a glass slide. A mix of original, I, II and III powders was made, as in the previous experiments, and each one was placed in the hole in one of the four prepared slides. A second slide was placed over each one and pressed down to squeeze out the excess cement, so all the specimens would be of uniform thickness. They were sealed with varnish, which was allowed to dry, and the slide was then placed in a beaker of water at room temperature for four weeks.

Four holes 1 cm. in diameter were cut in a cardboard, spaced far enough apart in a row to allow each one of the specimens to be centered under each hole. This was then set on a frosted glass cover over an illumination box and the degree of transmission of light through each specimen noted.

The results are shown in Table 6.

The fact that the fine particles are less translucent may be attributed to the enormous number of internal and external surface reflections and refractions of the surfaces of the fine particles. The significance of these differences in translucency, corresponding to particle size, cannot be immediately determined. The fact that while there is a steadily increasing translucency with increased par-

ticle size and, at the same time, a greater translucency in the original, with mixed particle sizes than with any of the mixes with approximately uniform particles, presents an apparent contradiction for which no explanation is evident. Moreover, it is unknown what degree of translucency is most desirable. The slighter translucency of the fine particles may be better than the greater translucency of the large particles. At present, nothing is known of the degree of translucency of enamel.

Clinical evidence of fillings in the teeth, made with cements of the respective particle sizes, would help to determine which is the better in this respect. Also, laboratory studies on translucency of enamel, and comparison with that of cements of different particle size, would help to clarify this question.

SOLUBILITY

A specimen was made of each of the four cements, as in the shrinkage and penetration tests, by packing the cement in glass tubes, sealing the tubes with varnish and setting the specimens in the desiccator for three hours. They were then removed and the ends ground smooth by rubbing a glass plate on which was some water and 200-mesh carborundum. The specimen was pushed out of the tube and washed in distilled water, and each one put in a test tube containing 15 c.c. of distilled water for two months. The tubes were shaken slightly each day during this time.

After two months, each tube was again shaken, and 5 c.c. of the liquid was drawn off from each test tube and put into four marked porcelain crucibles. The liquid was then evaporated, and the amounts of residue left in the crucibles were compared.

Because the supply of original powder used throughout the work as the standard of comparison had been exhausted, the specimen for this experiment marked "original" was made from another bottle. This powder contained a light pigment, and it was interesting to note that there was a slight yellow tinge to the water in the test tube containing this specimen.

In my opinion and that of others, the amount of residue that was left in the crucibles from the liquids of the original, II and III were about the same, and all agreed that I was definitely less.

No definite conclusions based on comparisons could be made from this experiment except that all the specimens were soluble in distilled water, and that the specimen made from the fine particles was the least soluble.

Aside from the object of this problem, the apparent solubility of the pigment, which was shown by the original specimen in this test, is worthy of further research.

COMMENT

In support of clinical knowledge, the data herein show that there is much room for improvement in silicate cements. Nothing in this work was done on the composition of either powder or liquid. Because the mixes with fine particles set with too great rapidity, a buffer might be added to the liquid to permit sufficient time to spatulate and insert the cement, using the maximum amount of powder, provided a powder uniformly finer in texture than those now manufactured was used.

This can be readily recommended to the manufacturers because the medium and fine particles uniformly gave the best results in all tests, except translucency, and as we have no means of judging what is the optimum degree of translucency, we cannot say that the lower degree of translucency of the fine mixes is detri-

mental. The standard silicate of today may be too translucent, and the pigments added undoubtedly exercise some control.

In like manner, one can readily say that the large particles are a detrimental factor to the cements. They are definitely the weak element in crushing strength, shrinkage, penetration and setting time. The fact that they are the most translucent cannot be adjudged, as already indicated, either an advantage or a disadvantage.

Three minutes is a more desirable setting time than four minutes, because the possibility of a disturbance of the gel is not so great while the cement is setting in a cavity in the mouth.

CONCLUSIONS

1. In the specimens made for setting time, it was shown that a decrease in particle size caused a decrease in setting time, when the specimens were prepared under identical conditions.

2. When the amount of powder was decreased, the setting time was increased, if a given amount of liquid was used.

3. The specimens made from the large particles were the weakest in crushing strength, the specimens made from the medium particles the strongest.

4. Within limits, the smaller the particle size, the greater the crushing strength. Great fineness of the particles may possibly have weakened the set cement to a slight degree.

5. All the specimens made from this cement shrank to some degree.

6. The specimens made of the large particles shrank most, and there was a relative decrease in shrinkage when finer particles were used.

7. The specimens made from the large particles exhibited the greatest degree of penetrability, and likewise, there was a relative decrease in penetration when finer particles were used.

8. The effect of the large particles was not so great in the test for shrinkage and penetration, as the specimens made from the original and the fine particles were nearly the same.

9. The degree of translucency of the specimens was diminished as the size of the particles used was reduced. In this case, the specimens made from the original and the large particles were nearly the same.

10. All of the specimens made from this cement were soluble to some extent in distilled water. The specimen made from the fine particles was less soluble than the other three.

25 East Washington Street.

ARTHRITIS, WITH SPECIAL REFERENCE TO MOUTH MANIFESTATIONS*

By PHILIP FINKLE, M.D., New York City

THE existence of diseases of the teeth antedates recorded history of man, for fossil remains of primitive vertebrates of the Paleozoic era yield abundant evidence of the existence of such diseases as dental caries. The first evidence of arthritis in man appears in the fossil remains of the Neolithic period. In a fairly large percentage of Egyptian mummies, there is evidence of deforming arthritis.

The idea that disease of the teeth or mouth might be associated with disease elsewhere in the body is an ancient one—almost as ancient as is recorded history. In the Egyptian Papyrus of Ebers, some parts of which have an origin as remote as 3700 B.C., one finds a long list of diseases, with 700 different remedies. Although there is no direct evidence that the Egyptians suspected any relationship between disease of the teeth and disease elsewhere in the body, they did not treat dental and oral maladies in separate chapters, but included them rather among general diseases.

Hippocrates, who lived in 450 B.C., considered some maladies as being produced by a "humor" which became localized in a given part of the body. His notes contain many references to the relation of the teeth to more remote organs of the body, and to the body as a whole. These notes also contain a rather vague report of the cure of two cases of rheumatism by eradicating mouth disease.

In the Hebraic Talmud dating from 200 B.C. to 300 A.D., there are references to the relation of the teeth to other parts of the body.

In 285 A.D., Theophrastus speaks of tartaric disease. Concerning "dental tartar," he says that sometimes it forms gout, sometimes stones in the gallbladder; etc. Already we see here the concept that affections of the teeth cause disease in remote parts of the body.

Fabricius, in 1560, showed a relationship between severe hemicrania and dental diseases. He reports the cure of a headache by the extraction of decayed teeth.

Pierre Fauchard, the father of modern dentistry, in 1728 had an idea of the relation of disease in the teeth and disease elsewhere in the body, the teeth acting as a focus. "It must be remembered," he wrote, "that when a portion of our body is inclined to pain, the same may be traced to teeth so long as they remain in their alveoli and are covered by their membrane."

The first unequivocal reference to a direct relationship between arthritis and the teeth was by Benjamin Rush, military surgeon in the American Revolution, and signer of the Declaration of Independence. In 1801, he reports a case of "rheumatism" in the hip joint accompanied by severe toothache, the "rheumatism" being cured by extraction of the tooth.

In 1803, Strickland, of Baltimore, reported two cases of "rheumatism" cured

*Read before the Dental Society of Mt. Sinai Hospital, April, 1935.

by the extraction of diseased teeth.

Almost a century passed before the idea of focal infection took root and was expounded with great vigor and activity.

The work of E. C. Rosenow, Billings and others, about twenty-five years ago, was responsible for a great deal of activity in the study and discussion of the problems relating to focal infection. Rosenow, at this time, began to expound the theory that such diseases as acute rheumatic fever, acute appendicitis, erythema nodosum, cholecystitis, herpes zoster, chronic arthritis, etc., were all due to a streptococcic infection. For each of these conditions, a specific strain of streptococcus was responsible. A streptococcus isolated from an apical abscess in a patient suffering from arthritis produces an arthritis when injected in animals. A streptococcus isolated from infected tonsils in a patient suffering from herpes zoster would, when injected into the blood stream of an animal, produce lesions in the skin closely resembling herpes zoster. Each of these strains of streptococcus apparently has a specific affinity for a given organ or tissue; one, for the joints, heart and blood vessels; injection of the organisms producing rheumatic fever; another, for joints alone, injection producing arthritis; still another, for the gallbladder, injection producing cholecystitis. This idea of the selection of a particular organ or tissue by each strain of bacteria became known as the theory of "elective localization," or "selective tissue affinity," of Rosenow.

This work of Rosenow, Billings and others was the starting point of a new mode of approach to the problem of arthritis. Under the influence of this work, the dominant school of thought considered practically every case of arthritis as due to a focus of infection. The problem, then, was merely to find the site of the focus. There began a period of hectic activity in removing tonsils and of all types of procedure in the sinuses, and the enthusiastic extraction of suspicious looking teeth. In many instances, only too often the extraction of the teeth in arthritis stopped only when the patient had no more teeth. When it was found that the arthritis persisted even after tonsillectomy, sinus operation and removal of all the teeth, the problem was to find some other tissue or organ that could be removed, in the hope of finally finding the "focus of infection" in any given patient.

Gradually, the idea is beginning to take hold that the theory of selective affinity of Rosenow is only a theory, not an established fact. The many attempts by capable investigators to duplicate his experiments have failed. Perhaps one may best present the prevailing views regarding Rosenow's work by quoting Zinsser:

> Other observers have not been able to confirm this claim, and indeed, it is very unlikely that such a thing occurs. It is an interesting thought, yet a dangerous one to spread broadcast, since it has influenced clinical thinking to an extent not warranted by experimental fact. In the specific localization of organisms in the tissues, it seems to us much more likely that tissue factors are paramount, such as hypersusceptibility or local reduction of resistance.

There are now many theories to account for the etiology of arthritis. Some believe that there are factors whose nature we at present do not understand in the disease, and that it must be considered a general disease rather than a localized condition.

There are two main types of arthritis: (1) rheumatoid arthritis, or so-called chronic infectious arthritis, occurring usually in people from 20 to 40, and (2) hypertrophic osteoarthritis, which occurs at a later age. The former is considered

by many to be infectious. It is characterized by migratory swelling and pain in the joints in the early stage, and, in later stages, by deformity and crippling, with more or less atrophy of bony structure. In my opinion, the term infectious arthritis should be dropped. Hypertrophic osteoarthritis is not considered infectious, and is characterized by thickening of the bony structures. It occurs in older persons. I do not believe that this classification is a true characterization of the disease. Each type may possibly be a manifestation of the same underlying conditions, and there is, furthermore, no doubt that combinations of both types exist.

Various theories have been advanced to explain the nature of rheumatoid arthritis, such as that it is due to some endocrine disturbance, that it is a metabolic disturbance or that it is an infectious disease. Not one of these alone offers a satisfactory explanation for the various manifestations of this disease.

Regardless of the factors in any given case, a careful examination of the mouth may, at times, disclose some clue to a more accurate diagnosis, thus pointing to a more rational therapy.

Briefly, one may present some of the important points of consideration, both experimental and clinical, in favor of the focal infection theory. Numerous workers have found that the blood of arthritic patients shows the presence of agglutinins in high dilution against various types of streptococci, a phenomenon not found in the blood of normal persons. For this reason, they believe it practically proved that the arthritis is due to a streptococcic infection. It must be emphasized that this does not in any way prove a relationship between the streptococci and the arthritis. These agglutination reactions are frequently dependent on previously incurred sorethroat, or some low grade activity of streptococci in other parts of the body, even the intestinal tract. It is now known that there is not necessarily a relationship between the degree of this agglutinating power of the serum and the presence in it of factors that are brought into play by the protective mechanism of the organism against bacterial invasion.

Certain workers have found a specific streptococcus in blood cultures in cases of arthritis. Without criticism of their technic in obtaining these blood cultures, suffice it to say that these findings have not been confirmed. At Mt. Sinai Hospital, we have found, on occasion, positive blood cultures in such conditions as leukemia and pernicious anemia, etc. It is not believed that any significant relationship exists between pernicious anemia and streptococcic bacteremia, for example, merely because positive blood cultures are occasionally encountered.

By injecting cultures of streptococci into joints, many investigators have succeeded in producing arthritis in animals. On the other hand, others have been able to produce arthritis in animals by merely injecting normal blood serum into joints.

Let us direct our attention to clinical evidence. We have all seen examples of what appeared to be dramatic results of elimination of a focus of infection, such as an abscess at the apex of a tooth. There are undoubtedly occasional cases in which elimination of a focus is followed by alleviation of arthritis. But how often do we see cases in which the teeth and tonsils are removed and sinuses drained and every focus that can be found is eliminated, without any alleviation of the arthritis?

It is always a great temptation to ascribe the cure of a condition to the last remedial measure applied. In a condition such as arthritis, there are many factors and usually many measures are taken to combat the disease.

It is not uncommon to see women at the menopause who have arthritis of the hands of greater or less severity. A focus such as one or more infected teeth is found. This is eliminated, and, in due course of time, there is marked improvement or even disappearance of the arthritis. Are we warranted in ascribing the result to the removal of the focus? Perhaps the picture becomes clearer when it is realized that this type of arthritis frequently occurs in women at the time of the menopause. In such cases, general treatment alone may result in marked improvement in the course of time. In a fairly large percentage of such patients, the arthritis is transitory, clearing up spontaneously after the menopause has passed. An arrest or even a complete cure of arthritis at such a time would naturally be attributed to any therapeutic measures employed, removal or treatment of infected teeth included.

One sees numerous instances of the onset of arthritis many years after the extraction of all the teeth, and where no other focus can be demonstrated. In a report in the *Lancet,* in 1921, Mutch states that in 15 per cent of a series of cases, after the extraction of all the teeth, arthritis occurred in periods ranging from 2 to 20 years after the extraction of the teeth. Steindler reviewed about 5,000 cases of arthritis studied in a university hospital by specialist departments for possible foci of infection. In approximately 30 per cent of the cases, foci of infection were found. Only 2 to 3 per cent of these cases responded to the elimination of the foci.

The necessity for great conservatism in appraising the therapeutic measures directed at possible foci of infection becomes apparent. Does this mean, then, that arthritis is not an infectious disease, and that the presence of a focus such as an infected tooth cannot be considered the cause or even a contributing factor? There must be cases in which the presence of a focus of infection is the underlying cause, but I believe that these are relatively infrequent. There are a larger number of cases in which an existing focus is not the causative agent, but may nevertheless act as an aggravating factor. This gives us a clue as regards one phase of treatment. Whether or not one regards arthritis as due to the presence of a focus of infection, such focus or foci must be treated when practicable, since they may act as sensitizing sources and serve to aggravate the condition. One must be conservative regarding prognosis, as the effect of any therapeutic measure upon the course of the disease is uncertain. The most that can be said in advance is that a condition that might act to retard recovery is being eliminated.

We should not assume that in a condition such as arthritis, examination of the mouth beings and ends with a search for foci of infection in the teeth. Occasionally, one may discover in the mouth a clue to the underlying etiologic factors in a given case. Thus, a more rational therapeutic approach might result in great improvement, or even complete recovery.

We shall consider some of the more important conditions in which an arthritis may be associated with another condition, and in which some clue may be obtained from a lesion in the mouth.

ENDOCRINE DISTURBANCES

Hyperparathyroidism.—In the disease of the parathyroid glands known as hyperparathyroidism, there is a disturbance of calcium metabolism. The body keeps losing calcium constantly, the loss being far in excess of the calcium intake. This calcium comes from the bones, which act as a storehouse. The calcium loss may be so great that the bones become markedly depleted, the roentgen-ray examination revealing marked rarefaction. While

the teeth do not participate in this calcium loss, the jaw bones do. Some of these patients also have an arthritis. If, in the course of an examination of the mouth, one bears in mind the rarefaction of bone occurring in this condition, one may, on occasion, by discovering rarefaction in the mandibles on roentgen-ray examination, be instrumental in drawing attention to the underlying condition. Surgical removal of parathyroid cysts have, in some instances, resulted in recovery from the arthritis.

Myxedema.—Arthritis may sometimes occur in association with myxedema. In this condition, the teeth may become loosened; in extreme cases so loose, in fact, that they can easily be picked out. With this in mind, myxedema may, on occasion, be diagnosed on the basis of such a condition of the teeth. By appropriate treatment with thyroid extract, both the arthritis and the condition of the teeth can be greatly improved.

GOUT

The celebrated Graves of Dublin and, somewhat later, Trousseau, the French clinician, drew attention to the gnashing of teeth in patients suffering from gout. Some of these patients have an irresistible desire to grind the teeth, so much so that, in some of them, the teeth become worn down to the sockets. Because, to many, gout means a red, swollen great toe, many cases of arthritis due to gout are not properly diagnosed. Numerous examples can be given of patients with an arthritis that does not improve under treatment because the gouty nature of the arthritis is not recognized. The finding of such teeth as are mentioned above in a case of arthritis should lead to a suspicion of its gouty nature.

ACHYLIA

In a certain proportion of patients with arthritis, achylia gastrica will be found. The stomach fails to secrete hydrochloric acid, as determined by examination of the stomach contents. The administration of hydrochloric acid in such cases will at times be attended by gratifying results. Frequently, in cases of achylia, there exists a glossitis, the tongue being smooth (the papillae are absent) and glossy. The finding of a glossitis should lead to a suspicion of achylia, and consequent examination of the gastric contents as well as the blood.

VITAMINS

The rôle of vitamins in the causation of disease has in recent years loomed formidably in the minds of both the medical profession and the laity. This, in part, is due to the human desire to explain abtruse phenomena by one cause, or by as few causes as possible. Nevertheless, prolonged absence of one or more vitamins from the diet may lead to pathologic states. The absence of vitamin C from the diet leads, in extreme cases, to scurvy. It is possible that, in some cases, a reduced vitamin C intake might act as one of the predisposing factors in the production of an arthritis. I have found that some of these patients do show a lack of this vitamin. An examination of the gums might in these cases make diagnosis possible. In this condition, one often finds spongy, even bleeding gums—at times, a condition mistakenly diagnosed as pyorrhea.

SYPHILIS

There are specific types of arthritis due to syphilis. In one type, the so-called Charcot joint is diagnostic. This occurs most frequently in the knees, with swelling, thickening of the bone and a fairly marked tendency to spontaneous fracture.

Another type is syphilitic dactylitis, occurring in younger persons, usually in

congenital syphilis. This type involves the fingers. How can one be led to suspect syphilis? At times, in such cases, unmistakable evidence of syphilis may be found in the mouth: Hutchinson's teeth, leukoplakia of the buccal mucous membrane and scarring of the soft palate, or uvula.

While the finding of these conditions in the mouth does not with certainty stamp such an arthritis as syphilitic, it may direct attention to the possibility, which might otherwise be overlooked.

SUBACUTE BACTERIAL ENDOCARDITIS

Occasionally, an arthritis may be an early manifestation of subacute bacterial endocarditis. There may be no other signs or symptoms present. Careful examination of the mouth might reveal the presence of petechiae in the buccal mucous membrane, thus leading to the correct diagnosis.

From the foregoing, it becomes clear that arthritis is a manifestation of a general disease. If there is a common causative agent operative in all cases, it is still unknown to us. One or more important factors may be operative in any given case, and some of the points to be considered are: whether an anemia is present, the general state of the gastro-intestinal tract, whether the stomach is secreting hydrochloric acid, the presence of endocrine disturbances or gout and, finally, the presence of some infective focus.

Though this is not a discussion of the treatment of arthritis, I shall allude to some of the factors in treatment. It is clear that the treatment of arthritis cannot begin and end with the elimination of the foci of infection, such as diseased tonsils or teeth. Anemia, gastro-intestinal factors, possible endocrine factors and gout, as well as infective foci, must be taken into consideration.

The sufferers from arthritis offer a fertile field for exploitation by charlatanism of every variety. The victim of a chronic illness, such as this, frequently turns in desperation to anything that offers relief from hopeless crippling, to which many fall a prey. This has led to the use and abuse of vaccine therapy.

Vaccine therapy, though much abused, is, in certain case, valuable. Its failure in so many instances is due to its indiscriminate and improper use. If improperly employed, it may actually do harm because of focal and systemic reactions in a patient already sensitive to the various products of bacterial origin, usually streptococci.

There is much evidence that, in rheumatoid arthritis, there is a condition of focal and systemic sensitivity to streptococci, as can be ascertained at times by the intradermal injection of appropriate quantities of vaccine, or the nucleoproteins derived from streptococci. Unfortunately, it cannot be concluded from this that the whole problem of etiology has been solved; but it may be that the condition of sensitivity to gram-positive cocci, especially streptococci, may be an important background in the development of arthritis. If this is true, the elimination or lessening of this sensitivity might serve to check the progress of the disease, and perhaps lead to its amelioration. The laboratory gives us a clue to the procedure. Without going into detailed discussion, suffice it to say that animal experiments have shown that sensitivity arises from injection of bacteria into the tissue, either subcutaneously or intramuscularly. If the injections are made directly into the veins, no sensitization results, but there results rather a condition that has been termed "tissue immunity," which, in many respects, is diametrically the opposite of sensitization. Therefore, in order to em-

ploy vaccine therapy properly, one should, when it is feasible, determine first whether the patient is sensitive to the group of streptococci or their products, and then attempt to desensitize the patient by injecting the vaccines intravenously.

It must be emphasized at once that intravenous desenitization is not a procedure that can be indiscriminately applied; but, in skilful hands, with properly graded doses, it is a safe method, and, in some instances, is followed by gratifying results.

Vaccine therapy should not be employed unless all foci that may act as sources of infection are eliminated. The failure of properly administered vaccine therapy is, at times, due to failure to eliminate an infective focus. Any vaccine therapy must therefore be carried out in conjunction with the treatment or elimination of every source that may act as a focus of infection.

From the foregoing, it becomes evident that it is of importance, in all cases of arthritis, to examine the mouth carefully for clues that might lead to a correct diagnosis. To recapitulate:

1. The association of hyperparathyroidism and arthritis should be borne in mind, and rarefaction of the mandibles, as found on roentgen-ray examination, should be looked for.

2. Marked looseness of the teeth, in the absence of pyorrhea, should suggest myxedema.

3. Evidence of grinding down of the teeth occurs in gout.

4. A smooth glossy tongue should lead to the suspicion of absence of free hydrochloric acid in the stomach.

5. If the gums are spongy and bleeding, there may be a vitamin C deficiency.

6. Leukoplakia and evidence of scarring of the soft palate may be evidence of a previous infection with the spirochete of syphilis.

7. With a strong light, a careful search should be made for petechiae in the buccal mucous membrane. Their presence might draw attention very early to a subacute bacterial endocarditis as the underlying cause of an arthritis.

I hope that this discussion results in consideration of the patient with arthritis as one who is suffering from a general disease the major manifestation of which is the arthritis, and in leading you to search in the mouth for symptoms and signs of the general condition.

Bear in mind that the teeth may play a rôle, but permit me to caution you against those enthusiastic onslaughts in the course of which tooth after tooth is extracted, until the patient has not a tooth left, with the ephemeral hope that in one of these teeth will lie the magic key to the portal of recovery.

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FRACTURES OF THE MANDIBLE AND MAXILLAE*

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IN discussing fractures of the jaws, I shall not consider the pathologic fracture, or necessarily the age of the patient. The cause of fractures as a rule is an automobile accident, some crushing force or the kick of a horse. They are of two types, compound and simple, the latter occurring in the ascending rami and condyles.

When the patient is first seen, rest in bed is advised. A sedative should be given and a bandage provided. Diagnosis as a rule may be made without roentgenograms, but should be confirmed therewith later. At the same time, the presence of foreign bodies in the line of fracture and the position of the fragments as well as the condyles should be recorded. At the earliest possible moment, the method of reduction and fixation is planned.

Mandibular fractures are treated by using the occlusion as a guide and the maxillae are used as a splint for the mandible. There are a number of cases in which a Victoria metal cast splint of the lower jaw only will be sufficient, but interdental splinting is more satisfactory in my opinion. The most frequent positions for fractures of the mandible are at the junction of the body and the ascending ramus, the bicuspid region, the symphysis or the surgical neck of the condyle. On inspection, any external facial deformity is noted, and the occlusion is observed intra-orally. Palpation should be gentle. Fractures are easily felt unless hours have elapsed since the accident occurred. Roentgen-ray examination should be made as suggested above; i.e., whether the fracture is involved by the position of the teeth or tooth roots and, secondly, the position of the fragments. Without fail, the condyles should be examined for fracture.

Treatment, generally speaking, is early reduction, and interdental fixation may be accomplished by simple wiring, with the occlusion as a guide, and with the thought that external drainage may have to be provided. This seldom is necessary if reduction and fixation are early and adequate. There are a number of ways of using the heavy orthodontic wire for fixation. One method commonly used is the so-called U. S. Army method, in which a loop is made by passing the wire around two teeth and fixing this loop on the buccal surface. The method I prefer requires the ordinary strand of heavy orthodontia wire, which is placed around the right second molar, twisted on itself until a twisted wire extends from the second molar to the central incisors. The same procedure is repeated on the left side, and then the two twisted wires are twisted together at the median line. In this way, a fairly firm arch is made for either the upper or the lower jaw. Individual teeth are then wired to this arch. When it is desirable to use interdental splinting, the wires or silk may be attached to these constructed wire arches on the upper and lower jaws.

*Read before the Section on Oral Surgery, Radiology and Anesthesia at the Seventy-Second Annual Midwinter Clinic of the Chicago Dental Society, Feb. 19, 1936.

When the teeth are poorly shaped or when a number have been lost, facsimile or cast Victoria metal splints with buccal snake wires are most valuable. Especially is this so for children, as the simple wiring may be supplemented by a cast splint. Interdental wiring is not recommended for child cases. Some operators prefer orthodontic bands and arches, or some modification of them; which I do not favor because of the discomfort necessary in applying orthodontic bands. In some of the edentulous cases, if the lower jaw has been fractured, circumferential wiring over the dentures or a vulcanite base is considered of value. I am recommending the simplest type of fixation and would call attention to the fact that I have not mentioned bone wiring, as I am of the opinion that it is not advisable, as osteomyelitis, which may develop, greatly complicates a fracture. It may be used in certain cases, but they must be well selected.

In the treatment of fractures of the maxillae, occlusion is the best guide for reduction. While simple wiring may be sufficient in a number of cases, I favor the use of the cast Victoria metal splints for the maxillae and mandible, with snake wire on the buccal surface of these castings. If the upper jaw is fractured, and the lower intact, the lower is used as a splint for maintaining the correct position of the upper, but, in some cases, the upper jaw is driven backward *en masse*. It is then imperative that the displaced upper jaw be forcibly brought forward and almost overcorrected and retained in position by interdental splints. In treating all cases of fracture of the upper jaw, a rubber-dam bandage is used for the first few days. I am not recommending such a splint as the Hammond, where wires extend from the mouth, but there are a number of cases wherein extensive splinting may be necessary. In such a case, I use a splint that is attached to the forehead and supported by the nose and then, with an extension from those two fixed points, an impression tray, or something resembling that, is attached to the lower portion for a splint. There may be many modifications of the extra-oral splint, but I am of the opinion that they are seldom necessary.

In the treatment of the edentulous cases, the upper and lower dentures, if available, may be wired together and placed in position and held by a rubber-dam bandage. In other cases, circumferential wiring is sufficient, or the forehead-nasal-oral splint mentioned above could be used. In some, it is necessary to retract the ascending ramus, as all teeth in the posterior fragment may have been lost. That may be accomplished in various ways. One method is to use a plaster-of-Paris head band and drop a piece of metal posterior to the ear, this metal being attached to the ascending ramus by wire in such a way that, by a twisting of the wire, the ascending ramus will be drawn backward and upward. This is frequently necessary, but is seldom used in my practice.

When a case is not seen early, that is, until five or six weeks after the accident, roentgenograms are taken and clinical examination is made before any plans for reduction and fixation are considered. It is generally necessary to refracture with chisel or saw, so that the occlusion may be improved. Generally speaking, interdental splints should be constructed and cemented before any operation is considered. If neck drainage in these cases is necessary, it should be made low down in the neck, and not over the so-called pointing area, and be dissected upward, drainage tubes being so placed that the resulting scar is the minimum. If the wound is allowed to rupture spontaneously, the scar is adherent to the

mandible, and this, in my opinion, is very undesirable, especially so in women.

In the treatment of nonunion of the mandible due to extensive loss, say 1 inch, of bone between the bicuspid area and the ascending ramus, or any place in the body of the mandible, due consideration should be given to infection. Seldom should any operation be performed earlier than from six to nine months after the last evidence of infection, as considerable time must be allowed for latent infection to disappear. During the six to nine months interval, some method of retaining the teeth in occlusion must be planned, and retention can generally be accomplished by an inclined plane or a bar splint if there are teeth in the posterior fragment. When operation is considered opportune, a constructed cast splint is cemented. Generally, the interlocking device is two tubes on the upper and one tube on the lower, with a fixing-pin. The anesthetic should be intratracheal, either ether or nitrous oxide. I prefer a free graft from the crest of the ilium. I have used rib, which I found to be too small, and the crest of the tibia, which was too dense, and I believe that the crest of the ilium makes the most adaptable graft. The approach is through the neck and, of course, with the most exacting bone technic. It is to be noted that when an interval of from six to nine months has elapsed, eburnation of the bony fragments will have occurred, and before the graft is wired in position, the anterior and posterior fragments should be denuded of the eburnated bone until bleeding occurs. The grafts are wired in position with heavy orthodontic wire. The interdental splint should be maintained in position for upwards of three months, and until union is demonstrable by use of the roentgen rays, which is seldom possible earlier.

The diet in all fracture cases is, in the first few days, fluids such as soups, "bovril," milk, malted milk, eggnoggs, gruels and fruit juices. Later, minced vegetables are given in small quantities. Food should be given every four hours. It is never necessary to remove a tooth for feeding purposes. The duration of the splinting period in most fracture cases is from three to five weeks.

901 Medical Arts Building.

ELECTROGALVANIC PHENOMENA OF THE ORAL CAVITY CAUSED BY DISSIMILAR METALLIC RESTORATIONS*

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HUMAN saliva contains the necessary elements for a good electrolyte, whether its chemical reaction is neutral, acid or alkaline; therefore, a galvanic battery has been constructed in every oral cavity where restorations have been made from two or more electropotentially dissimilar metals. This fact is as fundamental as the law of gravity.

In archives of medical and dental history, the possibility of electrogalvanism between dissimilar metallic restorations

*Read before the Section on Medical Relations at the Seventy-Second Annual Midwinter Clinic of the Chicago Dental Society, Feb. 18, 1936.

has been mentioned and a few clinical case reports published at intervals since the earliest days of metallurgic dentistry, though not until within the past six years, since a more thorough analytic and clinical study has been made, has this problem become one of serious pathologic significance.

One of us (E. S. L.) made mention of this phenomenon more than a decade ago, but, like other physicians or dentists, did not consider the matter of sufficient consequence to demand immediate clinical and laboratory investigation. It was late in 1930, after our observation of a succession of cases of oral cavity lesions in which all other etiologic factors could be eliminated, that the urge for a thorough investigation of the oral electrolysis began.

The first case reports and comments[1] on this subject were made before the American Medical Association in 1931. In two additional articles[2] further laboratory studies, case reports and clinical investigations are reported which are believed to fully justify certain deductions and conclusions.

Other physicians and dentists have, since 1931, made similar studies and published their findings and case reports in dental and medical journals, which have, in the main, agreed with our own. This paper, therefore, is largely a review and confirmation of our previous work, but is based upon an examination and study of more than 1,000 additional oral cavities which contained dissimilar metallic restorations.

1. Lain, E. S.: Chemical and Electrolytic Lesions of Mouth Caused by Artificial Dentures, Arch. Derm. & Syph., 25:21-31 (Jan.) 1932.

2. Lain, E. S.: Electrogalvanic Lesions of Oral Cavity Produced by Metallic Dentures, J.A.M.A., 100:717-720 (March 11) 1933; Electric Phenomena in Oral Cavity, D. Digest, 40:214 (June) 1934.

Studies of resistance of mouth structures and of spectroscopic examinations of tissue taken from ulcers and leukoplakia areas have further revealed the pathologic process of oral electrolysis.

SUBJECTIVE SYMPTOMS

The common symptoms of electrochemical change in the mouth we have classified as follows:

(1) metallic or salty taste, immediate in occurrence, though later tolerated or perhaps forgotten; (2) increased salivary secretion; (3) burning or tingling sensation, usually occurring first on the margins of the tongue; (4) occasional nerve shocks and pulp sensitivity from connecting restorations or from connections made by a spoon or table fork; (5) pathologic changes in the blood, kidneys or other organs, probably caused by absorption of ionized toxic metals, and (6) general discomfort in the mouth, irritability, indigestion, loss of weight and, in some cases, reflex radiating neuralgic pains through branches of the fifth (trigeminal) nerve.

During the course of our clinical studies, one of us (G. S. C.) has been particularly interested in the possibility of reflex sensory nerve disturbance arising from oral electrolysis.

Three positive cases of erosion and ulcer of the buccal and lingual mucosa had also presented a more or less constant neuralgia-like pain radiating from the area of the ulcers through the sympathetic branches of the trigeminal nerve. We have noted in some cases a slight itching, stinging, puckering sensation, especially at the trigeminal nerve endings on the mucosa. This may be explained on the basis of the law of referred pain.

After the establishment of a homogeniety of dental restorations in each case, not only did the mucous lesions promptly heal without other treatment, but also

the neuralgic pains slowly subsided and did not recur.

As the trigeminal or fifth nerve has both motor and sensory functions with branches that supply the various soft and hard structures of the oral cavity, it is not wholly speculative to assume that certain cases of persistent radiating neuralgia may be laid at the door of oral cavity galvanism.

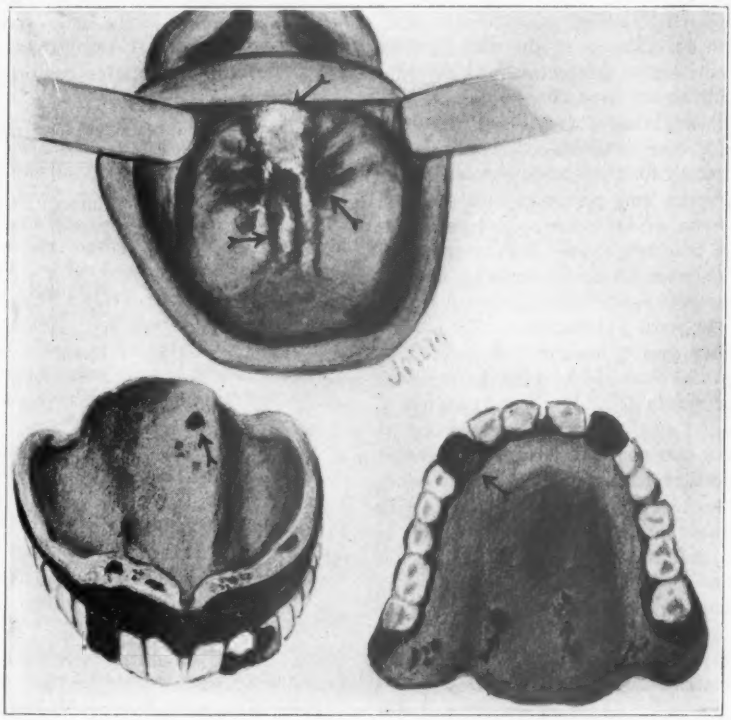


Fig. 1 (Case 1).—Electrolysis of aluminum denture and leukoplakia of anterior hard palate.

OBJECTIVE SYMPTOMS

Metals.—1. Disintegration and discoloration of metallic restorations: The electropositive metals give evidence of erosion characterized by a clean, bright appearance. In electronegative restorations, there is often a darkened, tarnished color, the result of the presence of sulfides and other ionized products, which have migrated from the positive metals, such as aluminum, zinc, tin, nickel and copper, through the saliva, to be deposited on the electronegative gold, platinum or silver fillings, etc.

2. Dental cement: Cement that contains a high percentage of zinc is also strongly electropositive in relation to the noble metals; hence, when it is exposed to the saliva, its rapid solution occurs. This permits a loosening or falling out of fillings, both silver and gold.

Mucosa.—In examination of the mucosa, there are found: (1) erythema with congestion and blanching of the mucosa, and evidence of intermittent or chronic irritation; (2) prominence and sensitivity of both anterior and posterior groups of the papillary bodies of the tongue; (3) erosion areas and ulcers on the margins, and denuded patches, geographic linguae, on the dorsal areas of the tongue, even the more severe symptoms being periodic and influenced by a change in diet, and (4) leukoplakia, a grayish, slightly elevated, precancerous lesion, usually resulting from a long period of chronic irritation, which may be nature's warning before more serious pathologic processes develop. Electrogalvanic lesions upon the mucosa most frequently occur adjacent to or near the positive metal, though sometimes occurring elsewhere.

Both visible lesions and subjective symptoms produced by electric irritation in the mouth depend on many conditions, such as: (1) the degree or amount of electric potential which may be generated between metals, the current flow being intermittent or continuous, varying with resistance of tissue and positions of the mouth and tongue; (2) toxicity of certain metals used in restoration alloys; (3) duration or time since the completion of the necessary elements of the galvanic battery.

Contributing factors consist of: (1) any rough or ill-fitting dentures or fillings; (2) infections by various microorganisms, and diseases that may also affect the oral mucosa; (3) alcohol, tobacco or other habitual mouth irritants, and (4) congenital or acquired personal sensitivity to certain metals, such as aluminum, nickel, copper, tin, and zinc, which is well known to dermatologists and industrial physicians.

We have repeatedly observed that infections, excessive use of alcohol or tobacco, disease and drug eruptions appear to lower tissue resistance to electric current, and, hence, give an increased meter reading. A variation of the p_H of saliva either to a strong acid or an alkaline, will give an increase of meter readings of from 30 to 50 per cent.

The paramount factor is the electrochemical difference in the heterogeneous metals used in dental restorations; in other words, their relative positions as found in the Standard Electromotive Series of Metals.

TABLE 1.—METALS IN ELECTROMOTIVE FORCE SERIES

Positive End	
Lithium	Cobalt
Cesium	Nickel
Rubidium	Tin
Potassium	Lead
Sodium	Hydrogen Oxide
Barium	Arsenic
Strontium	Copper
Calcium	Bismuth
Magnesium	Antimony
Aluminum	Mercury
Manganese	Silver
Zinc	Palladium
Chromium	Platinum
Cadmium	Gold
Iron	Fluorine
Thallium	Chlorine
	Bromine
	Iodine
	Oxygen
	Negative End

Positive cases of electrogalvanism will begin to improve at once and all lesions except leukoplakia, which is a hypertrophy of tissue, will heal promptly after the removal of prostheses of either the positive or the negative group. When lesions have healed, new restorations made with perfectly homogeneous metals are a guarantee against recurrence.

May we reemphasize a statement made in each of our former papers: Before a final diagnosis of electrogalvanic injury

to the oral mucosa is made, one should try to eliminate the possibility of certain fungus and Vincent's infections and skin eruptions, such as syphilis, lichen planus, herpes, erythema multiforme, lupus erythematosus and gastro-intestinal and blood dyscrasias, which may also cause similar lesions on the oral mucosa. To do this, it may be necessary to consult both an internist and a dermatologist.

LABORATORY EXPERIMENTS AND DIAGNOSIS

An attempt[3] was made with a wheatstone bridge, a galvanometer and other instruments to evaluate the factors of heat, resistance and direction of current flow through the various tissue structures of the oral cavity. We learned that the calories of heat generated by the average amount of electric current in the mouth are probably insufficient to cause an immediate destruction of tissue or a burn. We found that normal tooth enamel offers a very high resistance to current flow. Maxillary bone ranks second, or next highest, registering 18,900 ohms.

The buccal mucosa is next in order, registering 2,300 ohms. We were surprised to learn that the tongue gives the least resistance, 960 ohms, of all oral structures when tested either transversely or longitudinally.

There are many other important factors in electrical determinations which might raise a question as to the accuracy of our estimations, though our findings do suggest the possible answer to the question as to why the tongue appears to suffer the most frequently and severely of all oral structures.

The electrochemical potentiality or behavior of dental metals toward each other may be satisfactorily tested *en bloc* before casting into forms for various kinds of restorations by immersion in a glass tray containing a buffered solution, preferably of p_H 5.8 (acid), then make a contact of each with electrodes connected with the poles, negative and positive, of the microammeter.

For making electric estimations of potential damage to tissues, we prefer a Weston microammeter, model No. 440, which has a range of 75 microamperes. A model No. 220 has a scale of 200 microamperes, which is needed in only a few cases. The microvoltage, if desired, may be obtained by multiplying the microamperage by the ohms of resistance, which is recorded on a test of each instrument before leaving the factory.

REVIEW OF LITERATURE

From 1878 to 1918, Palmer,[4] Chase,[5] Mayer,[6] Patrick,[7] Morrison,[8] Grant,[9] Davis,[10] Essig,[11] Hepburn,[12] Manning[13]

3. Footnote 2, second reference.

4. Palmer, S. B.: Dental Decay and Filling Materials Considered in Their Electrical Relations, Am. J. D. Sc., 12:105, 1878-1879; Electricity in Mouth, D. Items Int., 10:399-402 (Sept.) 1888; Electro-Chemical Theory, Am. J. D. Sc., 14:166, 1880-1881.

5. Chase, H. S.: Filled Teeth as Galvanic Batteries, D. Cosmos, 21:106 (Feb.) 1879; Some Observations and Experiments Connected with Oral Electricity, Am. J. D. Sc., 12:18-25, 1878-1879.

6. Mayer, Charles: No Battery in Tooth, D. Advertiser, 21:103-107, 1880.

7. Patrick, J. J. R.: Oral Electricity and New Departure, D. Cosmos, 22:543-546 (Oct.) 1880.

8. Morrison, M. A.: Electric Currents of Oral Cavity, Dominion D. J., 14:86, 1902.

9. Grant, R. C.: Galvanism, Gold, Amalgam and Hahnemanian Theory, D. Digest, 8: 1110-1122 (Dec.) 1902.

10. Davis, C. P.: Electrolysis in Mouth, D. Items Int., 27:694-695 (Sept.) 1905.

11. Essig, C. J.: American Textbook of Prosthetic Dentistry, Philadelphia: Lea & Febiger, 1896.

12. Hepburn, W. B.: Behavior of Metal Fillings in Mouth, Brit. D. J., 33:1131-1139, 1912.

13. Manning, P. R.: Electrobiologic Theory of Dental Caries, Pac. D. Gaz., 26:335-370, 1916.

and perhaps two or three others mentioned the possibility of electric phenomena occurring between different metallic prostheses in the oral cavity. Their discussions dealt almost entirely with the possibility of such phenomena and with insufficient degree to cause any pathologic changes in the oral structures. Grant[9] even suggested that the stimulation of such a current was perhaps a benefit instead of injurious. Palmer[4] and Mayer[6] actually ridiculed the whole subject.

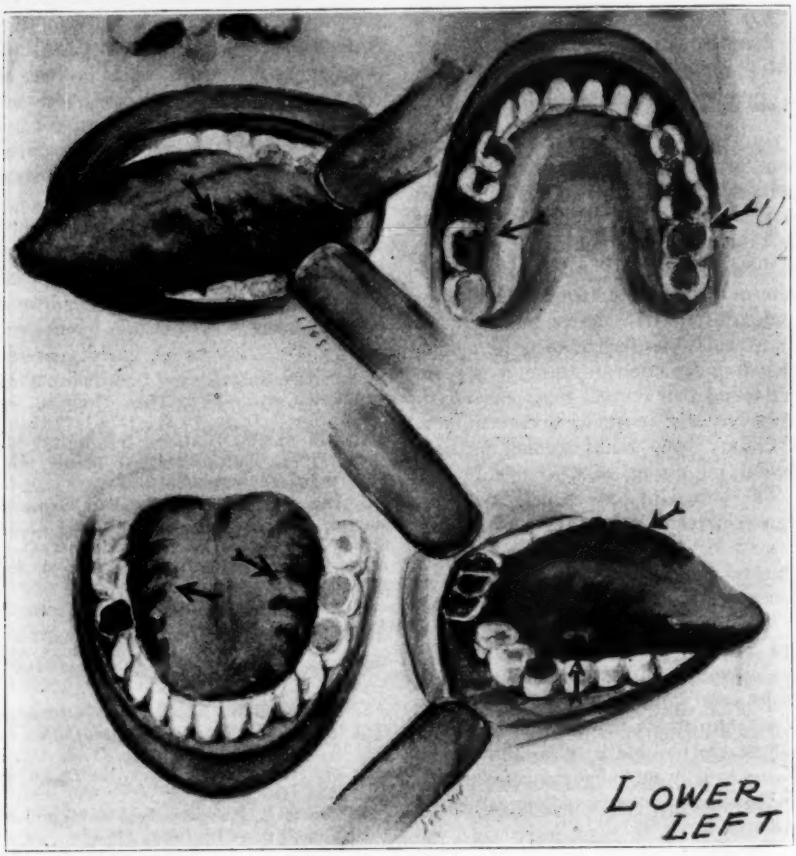


Fig. 2 (Case 2).—Erosion and ulcer of tongue which is in contact with multiple differently colored fillings.

reports of laboratory studies for confirmation.

They apparently reasoned that electrolysis between dissimilar restorations was of

Essig[11] and Manning[13] considered the matter more seriously, and each gave one case report. Essig's patient experienced frequent electric shock between fillings.

Manning reported tissue structure damage where a gold metallic clasp surrounded another tooth containing a silver filling.

Chase,[5] who had given more study to the problem, suggested that every plugged tooth doubtless became a galvanic battery ready for action only when the stimulant of an acid saliva surrounded it. He, therefore, considered a guttapercha water-tight filling best for the arrest of decay, rather than dissimilar metals.

Palmer[4] suggested the possible occurrence of disintegration and of loss of fillings as the results of oral electrolysis.

Ewing[14] (1929) suggested that "some metallic compounds used in plates develop measurable quantities of electricity, which is probably a factor in irritation of oral tissues."

Bloodgood[15] (1929) suggested that "now and then a patch of leukoplakia can be produced by irritation of a tooth, especially one with a metallic filling."

TABLE 2.—BIOSPECTROMETRIC EXAMINATIONS FOR METALLIC ELEMENTS IN BIOPSIES (SIX CASES)*

Case	Sex	Age	Restoration Time—Years	Calcium	Phosphorus	Magnesium	Boron	Tin	Copper	Silicon	Other Metals
1—S Leukoplakia, gingival and buccal patches	M	45	14	xxx	xx	xxx	xx				Normal amounts
2—A Early leukoplakia, gingival	F	23	8	xxx	xx	xxx	xx				Normal amounts
3—E Leukoplakia, lip	M	78	20		xx	xx	xx		xxx	xx	Normal amounts
4—S Leukoplakia, tongue ulcers, gingival	M	50	18	 xxx	xx xx	xx xxx	xx xxx		xxx	xxx xx	Normal amounts Normal amounts
5—O Ulcers, buccal	F	50	9	xxx			xxx		xxx	xxx	Normal amounts except for excess iron
6—M Ulcers, and geographic tongue	F	32	10		xx	xx	xx	xxx	xxx		Normal amounts

*Representing abnormal amounts only.

*A biospectrometric examination of biopsy specimens taken from the mouths of six patients who had ulcers, geographic tongue and leukoplakia revealed that there had been an excessive cataphoresis of calcium, phosphorous, magnesium, tin, copper, silicon and boron, which are electropositive elements commonly used in fillings, etc., cements and dentifrices.

14. Ewing, James: Bull. Chicago D. Soc., 9:7 (June 21) 1929.

15. Bloodgood, J. C.: Cancer of Mouth, J.A.D.A., 16:1354 (Aug.) 1929.

Hollander,[16] Hyams,[17] Macdonald,[18] Rattner[19] and others have each published one or more positive cases of oral mucosa lesions caused by dissimilar dental restorations.

Hyams[17] made a meticulous study of orthodontic materials in thirty-three cases and reports in detail histories of three cases that gave positive symptoms of electric irritation. He concludes that, in the light of positive findings of others and his own studies, it is wise to aim for homogeneity in the composition of orthodontic appliances, and to select filling materials which are not likely to set up electrogalvanic currents.

Macdonald[18] has published five cases which he diagnosed galvanic burns from dissimilar metallic reconstructions. Each of his cases was immediately improved or entirely relieved by a replacement with like metals.

Rattner[19] has published one very striking case of burning tongue and other symptoms thoroughly studied at intervals by several physicians over a period of seven years. His patient was given prompt and permanent relief by a removal of two amalgam fillings and replacement with gold, which was homogeneous with other gold fillings in the mouth

Soloman and Reinhard[20] have several times since 1932 published discussions of possible electrogalvanism in the oral cavity and offer confirmatory experimental proof that the elements of a galvanic battery do exist in a mouth containing electrochemically different metallic restorations. They also agree with a suggestion made by Chase[21] that since every amalgam filling is composed of several electropotentially dissimilar metals, probably each filling constitutes a miniature battery. They further emphasize that "electrical action from dental metals must be classified as a source of chronic irritation, and should be included among the etiological factors of precancerous and cancerous lesions of the buccal cavity."

They[20] recently published an exhaustive bibliography and brief review of dental and medical literature in which former physicians and dentists have mentioned or commented on the possibility of galvanism in the oral cavity between dental metals.

In a limited review of this bibliography, we have failed to find wherein previous authors have attempted to make an extensive clinical study of this problem. They seem not to have fully appreciated the pathologic significance of chronicity of oral electrolysis.

The subject of electrical potentiality between unlike metallic restorations has also been mentioned by five or six European physicians, though the subject was not given serious consideration until about 1930, when Lippmann,[22] of Leipsic, reported three cases that presented both visible lesions and severe systemic symptoms of metallic poisoning. Two of his patients were wearing highly electropositive upper full dentures of zinc and

16. Hollander, Lester: Galvanic Burns of Oral Mucosa, J.A.M.A., 99:383 (July 30) 1932.

17. Hyams, B. L.: Electrogalvanic Compatibility of Orthodontic Materials, Internat. J. Orthodontia, 19:833 (Sept.) 1933.

18. Macdonald, W. J.: Chemical and Electrogalvanic Burns of Tongue, New England J. Med., 211:585 (Sept. 27) 1934.

19. Rattner, Herbert: Burning Tongue, Arch. Derm. & Syph., 31:701-702 (May) 1935.

20. Solomon, H. A., and Reinhard, M. C.: Possibility of Oral Cancerous Lesions from Electrical Causes, D. Digest, 39:142 (April) 1933; Electric Phenomena from Dental Metals, D. Survey, 9:23 (Dec.) 1933; Electrical Currents from Dental Metals as Etiological Factors in Oral Cancer, Am. J. Cancer, 22:606-610 (Nov.) 1934.

21. Footnote 5, first reference.

22. Lippmann, A.: Disorders Caused by Electric Discharges in Mouth in Artificial Dentures, Deutsche med. Wchnschr., 56:1394 (Aug. 15) 1930.

a lower partial denture of Randolph metal. Each eventually suffered extreme constitutional symptoms of metallic toxemia with kidney, blood and other disturbances.

As proof of his conclusions, he removed the offending dentures for a period. This gave his patients complete remission of all the former symptoms, after which he replaced the dentures, prompt recurrence of all the previous symptoms resulting.

Ullmann[23] (1932) reported nine cases at a joint gathering in Vienna of dentists and physicians. He likewise proved his contentions by experimental removal and replacement of the clashing electrochemical dental metals in several cases.

Freidlander[24] (1932, Hamburg), delivering a postgraduate dental thesis, reported seventy-six cases of visible and other symptoms of electrogalvanism in the mouth from dissimilar metals. Several of her patients submitted to experimental proof of removal and replacement. Her statistical tables show that 56 per cent of her cases having dissimilar restorations were conscious of, or exhibited, oral mucosa injury.

COMMENT

Large statistical tables in clinic cases are cumbersome and tedious, and may reflect any idea about which the author may be overenthusiastic. Therefore, we shall present only a summary of symptoms and lesions found in a careful tabulated study of more than 1,000 adults whose mouths contained two or more dissimilar metals: those having minor subjective symptoms, such as metallic taste, tingling, intermittent sensations of tongue, 69 per cent; electric shocks, prominence of papillary bodies of the tongue, occasional erosions, 33.7 per cent; patches, geographic tongue, ulcers of the buccal or lingual mucosa, 28 per cent; leukoplakia and other precancerous lesions, 6.2 per cent.

One or more of the above-named symptoms may occur concurrently in the same patient, though rarely before several months, and, in most cases, from ten to twenty years after the elements for an electric battery have been completed in their mouths.

In a previous presentation of this subject, the possibility that leukoplakia might be caused by electrical discharges, and its precancerous significance were mentioned,[2] but this type of lesion was not elaborated on. We have since observed many additional cases of leukoplakia, which usually occur nearby or in direct contact with the electropositive prostheses. One patient, first examined four years ago, and who refused to have the prostheses changed, was recently recalled for reexamination. A second patch of leukoplakia has since developed, on the opposite buccal surface, and the original patch now gives all clinical appearance of having become malignant.

Considering that every oral cavity containing dissimilar metallic restorations is a constant potential chronic irritant, the percentage or number of persons who seek the aid of a dentist or physician is surprisingly small.

It is a common and somewhat perplexing observation that in certain cases presenting a relatively high meter reading, there are no visible lesions of electric injury in the mouth; nor are the patients conscious of any appreciable discomfort except perhaps an occasional metallic taste or electric shock when a fork or spoon may complete the circuit between two opposite restorations.

23. Ulimann, Karl: Leukoplakia Caused by Electrogalvanic Current Generated in Oral Cavity, Wien. klin. Wchnschr., 45:840 (July 1) 1932 (abstr.).

24. Freidlander, Ruth: Electrolytic Manifestations in Oral Cavity in Presence of Two or More Metals, Monat. f. Zahnheilk., August 15, 1932 (abstr.).

On the other hand, we have observed numerous patients who suffer from metallic taste, burning of the tongue and perhaps erosions of the tongue or patches of leukoplakia on the gingival or buccal mucosa, though registering a current of not more than 4 to 10 microamperes. Admitting that the determination of

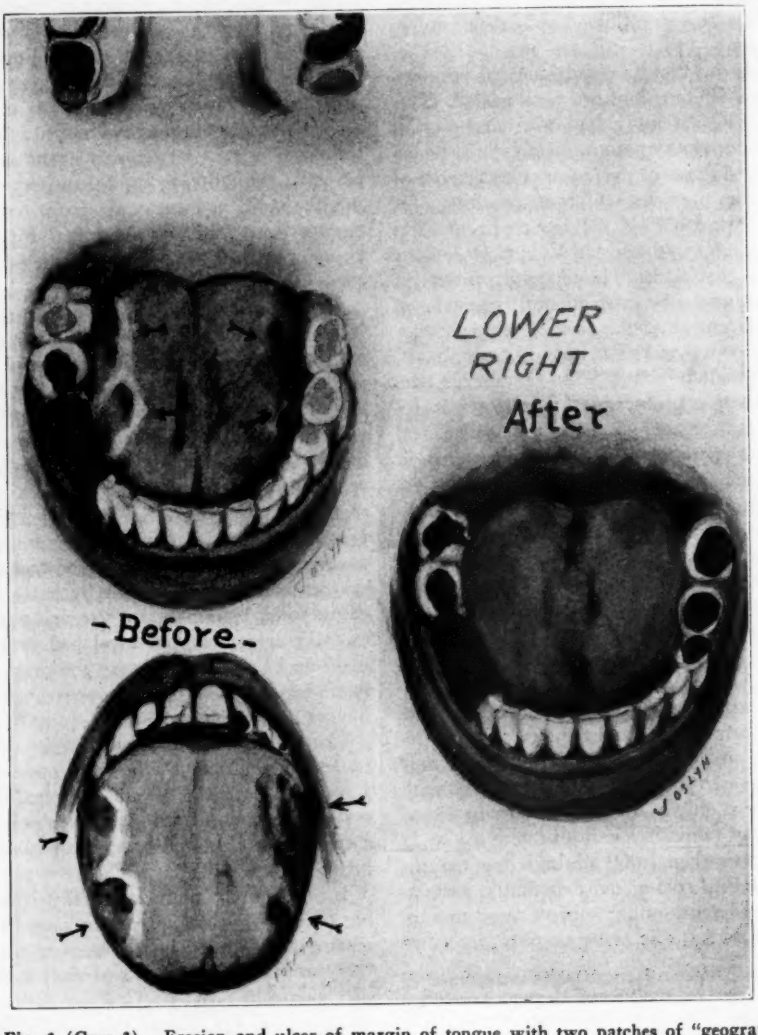


Fig. 3 (Case 3).—Erosion and ulcer of margin of tongue with two patches of "geographic tongue" on right side. (Case 6, Table 2.)

electrical units generated between dental structures as made by our present instruments of measurement, the microammeter and galvanometer, probably are only approximate estimations of the actual current potentiality, we may partially account for this seeming contradiction of ordinary processes of tissue injury.

REPORT OF CASES

CASE 1 (Fig. 1.)—Mr. H had been wearing an upper aluminum denture many years; with no trouble until three years previously, when a partial vulcanite lower denture with large gold bar was placed. Immediately, a metallic taste, with puckering and stinging sensations of the tongue and buccal mucosa, was noted. He came in May 18, 1932, because of sore mouth and a patch of grayish proliferating precancerous leukoplakia on the anterior hard palate. The electric measurement was 110 microamperes. The entire aluminum denture revealed evidence of electrolytic disintegration to marked degree, having several perforations in its base. The upper aluminum denture was discarded and the lower partial denture retained. The mucous patches healed and the leukoplakia began to fade after two weeks. At the end of four months, the leukoplakia had undergone almost complete resolution. A new upper denture of vulcanite was made, which the patient has since worn with comfort. The general health has improved and the mouth has remained healthy during the past four years.

CASE 2 (Fig. 2).—Mrs. C came in July 5, 1935 complaining of a congenitally furrowed tongue which was easily irritated. She had had a total of eight silver fillings (no gold) placed by dentists in various large cities during the past eight years. During the past three or four years, she had had a metallic taste, nerve shock and intermittent erosion and ulcer of the tongue. She had become extremely nervous, with loss of appetite and weight and resorted to occasional doses of narcotics in order to secure rest. Well-known internists in several of the larger cities had made gastric analyses and prescribed diets, medicines, rest, etc., which gave only partial relief. On examination, from 10 to 40 microamperes was registered between various and different colored silver amalgams. July 6, all fillings were removed, marked relief beginning within a few hours. Six days later, the tongue and other mucous lesions had entirely healed. As the general condition had improved, all cavities were refilled with high-grade gold. The patient was reexamined Feb. 28, 1936. She has had no recurrence and has continued to improve, and is now enjoying perfect health.

CASE 3 (Fig. 3).—Miss M (Case 6, Table 2) came in Jan. 9, 1936. Restorations of two gold crowns and two or three silver fillings had been made ten years previously. Soon afterwards, a metallic taste caused minor discomfort. Three years previously, three or four additional silver fillings were placed in molars. Increase in the sensations was noted on the margins of the tongue, with general oral discomfort. Six months previously, two gold bridges had been placed, one above another in the lower jaw. Also, other silver fillings were placed. Immediately, increasing discomfort, erosion, ulcer of the tongue and radiating neuralgic pains through the sympathetic branches of the trigeminal nerve were noted. Denuded-like patches (geographic tongue) began to spread from the margins over the dorsum of the tongue. The patient had now become extremely nervous, with loss of appetite and weight. She was taking 6 grains of amytal at night in order to secure rest. From 16 to 18 microamperes was registered between the prostheses. January 11, all gold was removed, noticeable relief beginning within a few hours. The amytal was discontinued the second night. The ulcers healed in seven days. The geographic patches on the tongue healed in three weeks. The neuralgia slowly subsided. The blood count has improved and there has been a gain in weight. Spectroscopic examination of biopsy specimen taken from the patch on the margin of the tongue, January 22, revealed an excess deposit of copper, tin, magnesium and phosphorus.

SUMMARY AND CONCLUSIONS

1. In every mouth in which there have been placed two or more restorative metals, electrochemically dissimilar, there has been established a galvanic battery, which serves as a chronic irritant.

2. The most important factor in estimating the volume of electric current between various dental alloys is their relationship to each other as determined by the standard electromotive force series of metals.

3. Common symptoms consist of discoloration, erosion and disintegration of metals used in restorations; metallic taste, ulcers and geographic tongue; with tingling and occasional electric shocks when dissimilar prostheses come in contact with each other.

4. Systemic symptoms or visible lesions depend on many conditions, such as duration of the current, the presence of certain diseases and infections and counterirritants such as ill-fitting prostheses, as well as the use of alcohol and tobacco.

5. The more striking and serious lesions, such as chronic ulcers, leukoplakia and cancers, or the blood dyscrasias may not appear for many months, sometimes ten to twenty-five years after the elements constituting an electric battery have been placed in the mouth.

6. Positive cases of electrolytic injury are promptly relieved by removal of either the positive or the negative metals. There are no recurrences after replacement with restorations which are electrochemically balanced.

7. Quantitative spectroscopic analysis of tissue taken from lesions in the mouth gives positive evidence of ionization and cataphoresis of dental metals and dentifrices.

8. Oral electrolysis can be avoided by testing dental materials in buffered solution outside the mouth before casting into forms for restorations.

9. Electrogalvanism between heterogeneous dental restorations is a serious pathologic problem, demanding early solution and correction through the cooperation of the metallurgist, the dentist and the physician.

ELECTROCHEMICAL ULCER OF THE BUCCAL MUCOSA: REPORT OF CASE*

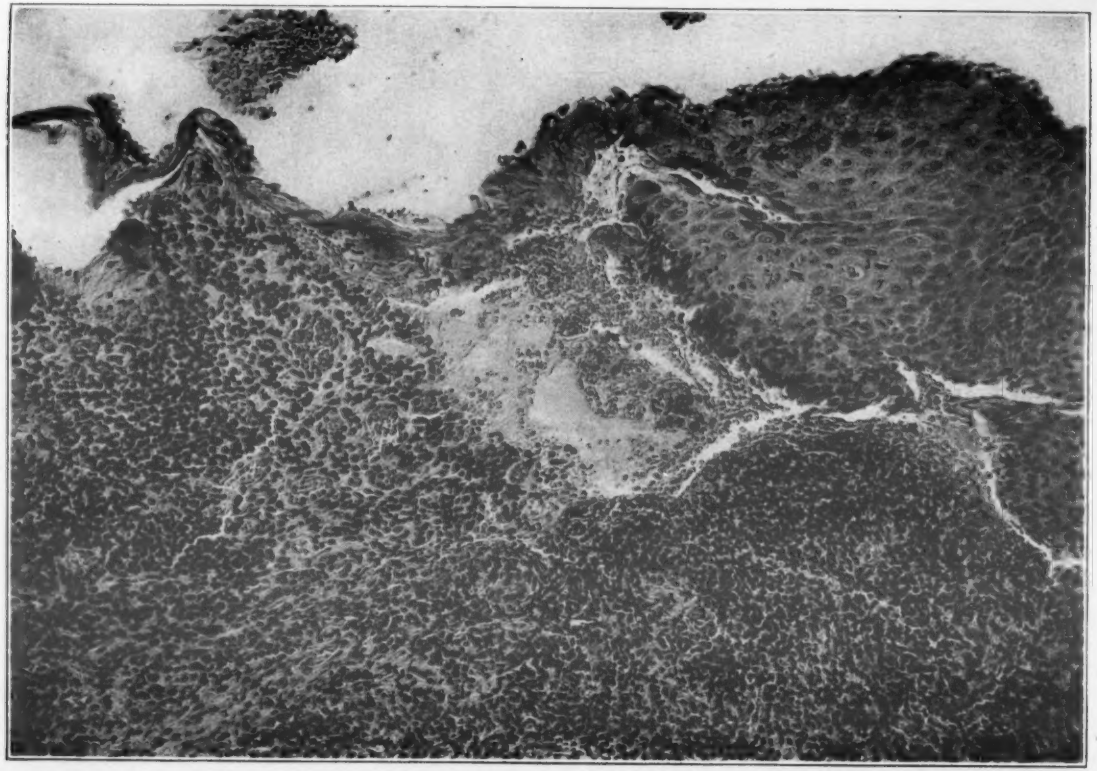
By NORMAN W. ROOME, M.D., and A. A. DAHLBERG, D.D.S., Chicago, Ill.

CHRONIC ulcerative lesions of the buccal mucosa in relation to metallic fillings and appliances in the mouth have been described for many years. Recently, attention has been directed to a special type of such ulcers, due to the presence of dissimilar metals in the mouth, and these have been explained on the basis of electrolytic action by Hollander,[1] Lain[2] and others. These authors suggest that the dissimilar metals act as a miniature galvanic cell, with the saliva as its electrolyte, and that this action results in a concentration of various ions on the surfaces of the metals. These ions

*From the Department of Surgery, the University of Chicago.

1. Hollander, Lester: Galvanic Burns of Oral Mucosa, J.A.M.A., 99:383, (July 30) 1932.

2. Lain, E. S.: Electrogalvanic Lesions of Oral Cavity Produced by Metallic Dentures, J.A.M.A., 100:717 (March 1) 1933.



Photomicrograph of margin of buccal ulcer, showing mucosa at right edge and ulcer floor at left. There is intense infiltration beneath the ulcer. (×175.)

cause injury and finally destruction of the adjacent buccal mucosa, and a chronic ulcer results. Measureable electric currents have been found to occur.

Such an ulcer, due to the presence of a double filling, is here described. It is thought that this type of buccal ulcer is more common than is generally supposed, and that the reporting of even a single case may direct attention to the lesion.

REPORT OF CASE

R. E. T., a white man, aged 32, an office worker, was admitted to the University of Chicago clinics, Jan. 20, 1934, complaining of an ulcer of the buccal mucosa that had remained unhealed for one and one-half years. The patient thought that it had developed from his biting the cheek accidentally, and a dentist had ground down the adjacent teeth, but without benefit.

On examination, there was a shallow ulcer 2.5 mm. in diameter on the buccal mucosa immediately opposite a filling in the second left lower molar tooth. It had a grayish floor and slightly hyperemic border and was soft and pliable, giving no clinical evidence of malignancy. In view of its chronicity, it was excised, January 23, and when examined February 1, the wound had completely healed.

There was at this time, a new ulcer, about 1 mm. in diameter immediately below the scar, and again in relation to the filling. It was then learned that the filling was made up of a copper alloy filling and a gold filling with their edges in contact, and that the ulcer had first developed a few months after the addition of the copper alloy filling to the gold one. This filling was then insulated by a thin layer of cement, February 5, and the lesion disappeared in one week.

It may be noted here that there was no roughness palpable on the surfaces of the filling, and that the cement was slightly more rough than the original filling. When the cement was removed, the ulcer recurred in a little less than a week, disappearing again when the cement was replaced. The filling was finally removed and replaced by a homogeneous gold inlay, and the ulcer did not recur. The saliva was slightly acid to litmus paper.

Microscopic examination of the excised ulcer revealed a normal buccal mucosa at its margin, and dense infiltration of its floor by round cells and polymorphonuclear leukocytes, as shown in the accompanying figure.

COMMENT

In the case described, the ulcer seems to have been definitely due to electrochemical injury, since mechanical irritation was apparently not a factor, and insulation of the double filling caused prompt disappearance of the lesion. About a week of exposure to the filling was necessary for the recurrence of the ulcer, as tested by excision of the ulcer and by removal of the insulating cement, although it had first developed some months after the insertion of the filling.

It must be noted that, in this case, the two metals were in contact. It would seem that such contact is necessary for a continuous electric current to flow, for, in the galvanic cell, no current flows unless the electrodes are connected. This consideration casts doubt on the importance of electrochemical action in the production of mucosal lesions when the various metals are separated in the mouth.

SUMMARY

A case of chronic buccal mucosa ulcer was due to the presence of two dental fillings of dissimilar metals in contact with each other. It recurred about a week after excision, disappeared when the filling was covered with cement and recurred when the cement was removed. It was the result, it is thought, of electrochemical action.

CONSTRUCTING AMALGAM FILLINGS BY REINFORCEMENT TO APPROXIMATE STRENGTH OF CAST GOLD*

By F. A. BULL, D.D.S., Milwaukee, Wis.

MANUFACTURERS have already given us about all we can hope for as regards various strengths and properties of amalgam. Technics of manufacture and manipulation are so scientifically complete that the best we can look forward to in the future is more in the nature of refinement than of great improvement.

We all know the various strength tests and properties that are published regarding amalgam, leading us to believe that its failure as a filling material in the mouth is due to the operator himself, in either cavity preparation or manipulation of the amalgam. Many of the amalgam fillings that we have placed in teeth have actually become failures and we know that other dentists are meeting with the same results, as we see more of the other man's failures than we do of our own.

I believe that failure in the face of careful preparation of cavities followed by proper manipulation of the amalgam itself has lead many good operators into careless habits in amalgam work. When they see much time spent in producing a failure, the question arises, Why spend so much time? The alternative was formerly a gold inlay, but present economic conditions have more or less done away with this. I believe that one look into a mouth with several amalgam restorations in it will show that many dentists have lost faith in their amalgam work, and still inquiry will reveal that the same operators do good inlay work.

It appears that the weaknesses and faults of the amalgam itself have brought about this state of affairs. Owing to his conviction that great bulk is necessary if amalgam is to have any strength, the dentist hesitates to trim and carve the filling properly, with the hope that this so-called overfilling of the cavity may supply the strength necessary to prevent the filling from fracturing or breaking out. To extend the cavity properly to the lingual and buccal aspect only increases the danger of fracture at the cavosurface angle and at the neck. Many two surface fillings are prepared without any dovetail on the occlusal aspect, as this means of retention has failed too often through fracture at the neck of the dovetail. Buccal and lingual wall retention alone is resorted to, even though it frequently results in the fracture of an entire wall. At least, the tooth fractures and not the filling.

To observe the amalgam gradually leave the cavity wall in a progressive spheroiding action, caused by the action of hot food and drink, does not inspire a great deal of confidence in the operator as to the end-result.

Amalgam technicians make the most

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of the expanding reactions of modern kinds of fast-setting amalgams. It will be observed that the shrinking reaction of amalgam in the mouth is due wholly to another condition and not the setting reaction. Amalgam expands during the setting reaction provided it sets fast enough. Slow-setting amalgam contracts during the setting reaction. Fillings that can be immediately inserted in the plastic state expand slightly on setting and harden almost abruptly, and the fact that there is no delay in carving and polishing naturally makes for popularity with the dentist. Practically nothing is mentioned about the tension expansion that is assured when amalgam is properly packed into a cavity. Little is said about the

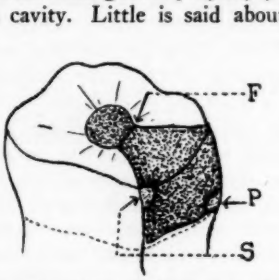

Fig. 1.—Amalgam weaknesses: *F*, fracturing; *P*, pulling away; *S*, shearing and pulling away. These defects in amalgam restorations are due to the mercury content and low strength of the amalgam.

practical shrinkage that takes place when amalgam is placed in the mouth. Amalgam fillings observed a week after insertion under a lens will appear to be tight and nonleaking provided no fracture has taken place. They will remain so until shrinkage sets in, or rather until they begin to undergo distortion. This is a progressive reaction speeded up by the ingestion of hot foods and drinks at meal time. The amalgam slowly and progressively bulges, pulling away from the cavity wall. When this occurs, not only is a leak caused, but also the edges are unsupported, and when force is applied to the edges of the filling, it chips and fractures, as there is no tooth tight against the filling material to support it.

It is evident that the liquid mercury is chiefly responsible for the distortion that takes place in the amalgam at above room temperature. The rapidity and amount of the distortion are governed chiefly by the amount of mercury in the mass.

To command a reasonable fee for his services, the operator must know that the material he is using for a filling does not have any physical weaknesses that may make the end-result unsatisfactory. Any material that is used as a permanent fill-

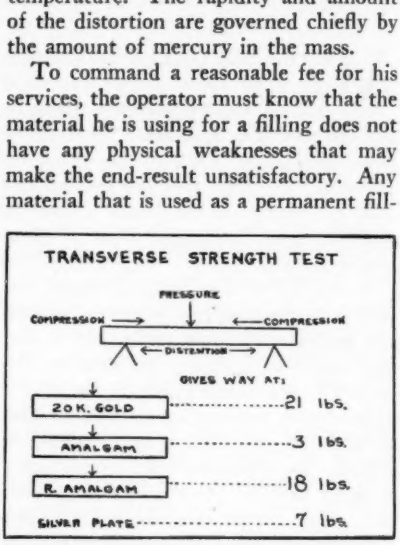

Fig. 2.—Transverse strength test.

ing in a tooth must be of such nature that, when it is properly placed in a scientifically prepared cavity, no doubt remains in the operator's or the patient's mind as to its ability to "stand up" under the various forces, stress and temperature changes in the mouth. Unless such a material is available, we must consider failures a direct result of the nature of the material itself and not the fault of the operator. A compound cavity in a tooth certainly does weaken the tooth structure, but when this weakened tooth structure "stands up" and the filling materials give way, evidently something is wrong with the filling material itself.

A diagram of a compound cavity will serve to indicate how amalgam weaknesses and faults affect completed fillings (Fig. 1). Regardless of the size, shape or location of a cavity, one or more of these defects: a fracture at the neck, a pulling away at the cavosurface angle allowing a leak and shear fracture or a pulling away at the angle of the gingival seat allowing a leak, are bound to appear in the amalgam filling sooner or later, usually all too soon. Fractures or breaks of the filling are due to the use of certain low strengths of the amalgam; while the other faults are the result of the mercury content, which is about 50 per cent of the mass. It is obvious that both of these conditions; namely, low strength and distortion, must be improved before better results can be obtained with amalgam fillings. Cast gold inlays, when properly made and correctly inserted in the teeth, "stand up" very well. The inlay has sufficient strength to withstand the forces of mastication, and no mouth conditions cause it to change its shape or be distorted. It has been my objective to incorporate these desirable and necessary properties of the inlay in an amalgam filling.

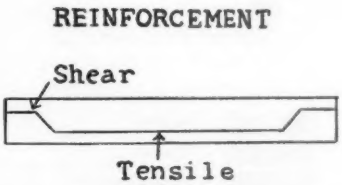

Fig. 3.—Reinforcement of amalgam at surface angles in close contact with cavity wall, which helps to prevent distortion caused by action of heat on mercury content.

The blame for the failure of an amalgam restoration is always placed on the shoulders of the dentist by amalgam manufacturers and technicians. This is a rank injustice to the average practitioner. Most amalgam failures are in the same category as silicate or cement failures. The material itself simply has not the qualities that are essential to a permanent restoration in the mouth.

Manufacturers and sales agencies have the knack of painting some beautiful pictures for us. After certain tests of their product, they remind us of the tremendous strength their amalgam possesses. Unfortunately for us, they do not give the true picture as no reference is made by them to the tests that reveal the glaring weaknesses of their own product. Furthermore, pounds per square inch have little meaning to us when we are working with millimeter measurements.

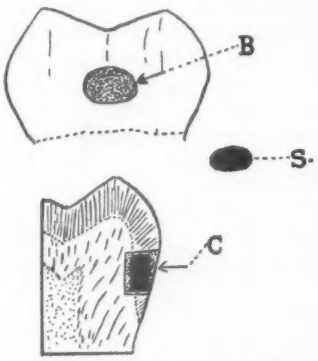

Fig. 4.—*B*, buccal amalgam reinforced with 90 per cent silver plate. *S*, silver plate. *C*, cross-section of amalgam. The plate is cut to loosely fit the cavity. Then plain amalgam is packed into the cavity before the plate is tapped into place. After the plate is placed, more amalgam is packed and the filling is finished in the regular manner.

As we use amalgam for a filling material, one of the most important practical tests it can be subjected to is its ability to withstand the transverse strength test. After all, practical tests are the all important ones as they tell us whether a material "stands up" instead of the

pounds of resistance per square inch. Nowhere in dental literature have I seen a report on transverse strength; and yet, testing engineers tell me that it is one of the most important practical qualities where irregularly shaped material, such as in a filling, is required to stand great pressure or force. Let us consider this transverse quality of a material.

The breaking of a match with both hands illustrates the idea of transverse strength. Laboratory materials to be tested are prepared as to size and shape, and then placed on blocks supporting both ends. Pressure is then applied at a point midway between the supports and

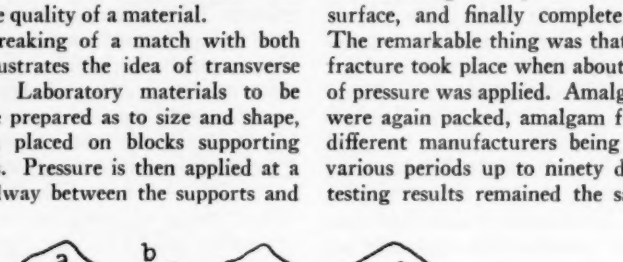

Fig. 5.—*a*, cavity; *b*, plates; *c*, amalgam at gingival seat; *d*, gingival seat plate tapped into place; *e*, amalgam over plate and occlusal portion of cavity; *f*, occlusal plate tapped into place; *g*, amalgam over occlusal plate and v-shaped plates in place; *h*, cross-section of reinforced amalgam. These plates become chemically welded into the filling and the amalgam is forced to hug the cavity wall.

continued until the material gives way. Engineers have found that when this test is being conducted, the material at the point or side of applied force is compressed; while, on the opposite side, the material is stretched until complete fracture takes place. It is also noted that the outer surface of the material gives way long before complete fracture takes place.

With this picture in mind, several molds 1.5 mm. square and 15 mm. long were packed with amalgam normally mixed and allowed to stand for several days. Removed from the molds, these bars of amalgam were subjected to the above-outlined transverse strength test. As pressure was applied, the material was observed under a lens. First chipping and cracking took place on the tensile surface, and finally complete fracture. The remarkable thing was that complete fracture took place when about 3 pounds of pressure was applied. Amalgam molds were again packed, amalgam from three different manufacturers being tested at various periods up to ninety days. The testing results remained the same. Several of these materials were tested by finger pressure, and could easily be broken by the pressure of the index fingers and thumbs. The "margin of safety," if any, was very low.

These tests can lead to but one conclusion; namely, that amalgam in such dimensions as ordinarily used in the mouth has practically no transverse strength. Surely, there is nothing new about the transverse strength test. Certainly, no known test could show the

dentist in a more simple and practical way just how little force his completed filling will stand. Undoubtedly, the omission of this test has been intentional, as the results are discouraging to say the least. The crushing and flow test results make a much nicer picture to present to the dentist. Naturally, they alone are used for publicity purposes.

The transverse strength test calls to mind an important question. Which surface of a filling in a tooth will be compressed and which surface will be stretched? If an attempt is to be made to increase the tensile strength of amalgam fillings, this question is of greatest importance. The fact of the matter is that both upper and lower surfaces alternately become the tensile and compression surfaces. To illustrate this, pressure at the center of a mesioclusodistal filling would make the outer surface the compression area and the inner surface the tensile area, while pressure on the mesial or distal aspect of the same filling would reverse this order, placing the tensile area on the outer surface and the crushing area on the inner surface.

Construction engineering shows examples of problems similar to the amalgam problem; i. e., materials that are ideal for construction work as far as compression strength, surface durability, hardness, ease of manipulation and costs are concerned are sadly lacking in the most important property of resisting transverse strength. For example, the transverse strength of concrete is rated by testing engineers as very low, yet it is the most widely used material in construction work where resistance to great force is required. How can this weak material be used where great strength in the finished product is required? The answer is, by employment of scientific methods of reinforcing it. Endless experiments and tests have brought the reinforcing of concrete near to perfection. These tests show how wrong methods of reinforcing weakens the material and correct methods greatly strengthen it. The nature and strength of the material used for reinforcing and the strength of the bond formed are vital factors. To supply permanently to a material the desirable or necessary strength that the material itself does not possess is the ultimate goal. Should any physical or chemical properties of the material interfere with this necessary strength, the end-result will be weakening instead of strengthening of the material.

If we consider what has been done in the engineering field, it appears that something practical might be accomplished in reinforcing amalgam. Since we know the affinity mercury has for silver and that a silver reinforcing element would have about the same electrical potential as silver amalgam and that silver is but very slightly soluble in mercury, it appeared that a high silver alloy would be the logical material to use for the reinforcing element. Ninety per cent silver alloy was selected. A few simple tests proved that the amalgam formed a good bond or chemical weld with this reinforcing material; also, that the action of mercury on a high silver content alloy is confined to the surface and will not change the silver plate into an amalgam; likewise, the chemical weld formed would make a one-piece unit of the entire mass.

Recently, Dr. Paffenbarger, of the research associates at the Bureau of Standards at Washington, furnished evidence that, in 1899, a man by the name of Kellar established the fact that when granules or plugs or silver alloy were placed in amalgam, a chemical weld took place.

Correspondence with the U. S. Bureau of Standards and Metallurgy revealed that there were no experimental data on

this subject. The opinion was expressed that the procedure as outlined seemed to be practical from a metallurgic standpoint. Experimental work carried on over a three year period has verified these statements.

The matter was discussed with several engineers and metallurgists, as to the practicability of the experiment and as to the form and placement of the reinforcing element. These men all agreed that the latter should be a practical thing, as there is actually a chemical weld taking place between the reinforcing element and the amalgam itself which is much stronger than the bond between concrete and steel. They were of the opinion that experiments of a practical nature would have to be tried out in order to determine what methods of reinforcement would assure the greatest strength. There was no scientific information available on this subject and the smallness of the area to be reinforced presented a problem that engineers were not acquainted with. Not only must the end-result be an increase in strength, but the procedure must be simple and not take much time, if it was to have any practical application in dentistry. Likewise, the placement of any reinforcing material in the amalgam must not interfere with the proper packing of the amalgam.

With the foregoing in mind, experiments were started. Those outlined in this paper are only the ones that revealed considerable strength increase and appeared to be practical from the dentist's point of view. The same molds that had been used to pack plain amalgam in were used; namely, 1.5 by 1.5 by 15 mm. A plate or bar of 90 per cent silver alloy metal about 1 mm. thick was cut out to loosely fit the mold. The mold was about half packed with amalgam and the plate was laid in the mold and gently tapped with a mallet until it was approximately in the center of the mold. Then, amalgam was packed over the plate until the mold was filled. Placing the reinforcing plate in the center would increase the tensile strength regardless of the direction of force. Several of these fillings were made and allowed to set for a week. They were first tested with finger pressure, but could not be broken that way. On the testing machine, they broke at about 18 pounds pressure. You will recall that plain amalgam of the same dimensions broke at 3 pounds pressure. Thus, this material showed a 500 per cent improvement over plain amalgam. The reinforced amalgam actually bent before it broke. Also, the reinforced amalgam showed a much sharper outline than did the plain amalgam.

Next, a 20-carat gold casting was made from the same mold, and when this was placed on the testing machine, it gave way at 21 pounds transverse pressure. That plain amalgam fractured on 3 pounds pressure, reinforced amalgam on 18 pounds and cast gold on 21 pounds certainly was encouraging to say the least (Fig. 2). Repeated tests proved only that the first figure was correct.

In conducting this transverse strength test, it can readily be seen that the amount of the material and the distance between the supports will vary the readings on this test. The experiments conducted were on bars of plain amalgam, reinforced amalgam and cast gold of exactly the same amount, and the same distance between supports was maintained in testing all three bars. The accompanying table gives an idea of some of the different results obtained.

Cylindrical molds about 4 by 8 mm. were now cut. Some were packed with plain amalgam and in the others loose circular reinforcing plates were placed in amalgam. After setting a week, these were given the compression or crushing

test. The plain amalgam on the average withstood 350 pounds pressure; while the reinforced amalgam averaged 600 pounds pressure before the fillings were demolished. This certainly showed quite an increase in the crushing strength for the reinforced material, and we know that the flow is cut down as the crushing strength is increased.

To ascertain just how much difference there would be in the flow between ordinary amalgam and reinforced amalgam, several specimens were prepared with the same brand of amalgam. Loose-fitting plates were used to reinforce the amalgam as in the specimens prepared for the crushing tests. Cylinders 4 by 8 mm. were used according to the Bureau of Standards specifications, but the tests were continued for one week instead of the twenty-four hour period. The results of these tests showed that the reinforcing plates reduced the percentage of flow slightly more than one-half. For example, a brand of amalgam that showed a flow of 6.98 per cent from the week's period only showed a flow of 3.47 per cent for the same period when reinforcing plates were used.

TRANSVERSE STRENGTH TEST

	Material	Pounds
Bars 20 mm. long	Plain amalgam	3
65 — 100	Reinforced	18
1,000 — 1,000		
	Gold	21
Silver plate gave way at 7 pounds.		
Bars 14 mm. long	Plain	4
65 — 65	Reinforced	24
1,000 — 1,000		
	Gold	26

The experiments and tests outlined so far in this paper lead to certain conclusions: 1. It is possible to increase the already good strength properties of amalgam as to its strength; i.e., crushing and flow, by about 100 per cent. 2. Where amalgam is admittedly weak; namely in tensile and transverse strength, a 500 per cent improvement can be made by proper reinforcing. 3. The mercury content of the mass, which is the element that caused the distortions, can be cut down at least 100 per cent.

These tests showed that the same reinforcing principle used here to increase the tensile and transverse strength could be utilized also to increase the crushing strength and reduce the flow. Provided the reinforcing plate was fashioned to be coextensive with the outline of the mass, transverse, tensile and crushing strength increased and the flow was reduced in all parts of the mass. This feature is very important from a practical standpoint as cavities in the mouth are of varied shapes and patterns, and any point may be subjected to great pressure during mastication. The limits of the bond formed by any reinforcing material are definite, and beyond that limit no increase in strength is obtained. If the reinforcing plate is cut to be coextensive with the cavity outline, there is no chance of its being outside the bond area.

Equally important from a practical standpoint is the fact that with a reinforcing plate fashioned to be coextensive with the cavity outline, the greatest possible area of the completed filling is being taken up by the reinforcing plate itself, the total amount of amalgam in the complete filling being cut down thereby. Naturally, as less amalgam is used in the filling, the chief offender, mercury, is present in a lessened amount. If a rigid reinforcing plate is fashioned to be coextensive with the cavity outline, it can readily be seen that when it is tapped into the mass of already packed amalgam, a greater amount of mercury can

be expressed, as there is actually compression of the entire mass. This undoubtedly accounts for the fact that much sharper detail could be seen in the models that were constructed with a reinforcing plate. Again, a rigid reinforcing plate that has become chemically welded in the amalgam mass cannot but greatly cut down any internal stress or spheroiding action that is exerted by the material itself.

Laboratory experiments and tests showed the reinforcing principles as outlined to be simple in procedure and practicable as to application. Laboratory experiments such as have been outlined are one thing, and the actual construction of fillings in teeth is another. In order to determine the practicability of reinforcing actual fillings, a series of experiments on extracted teeth were carried out.

Several two-surface cavities having a neck about 1.5 mm. wide were prepared in extracted teeth. No undercut was used, as the fillings were later to be removed for testing. Plain amalgam, reinforced amalgam and cast gold fillings were prepared in the teeth and, on removal, were tested on the machine for transverse strength. The results were: plain amalgam, about 2½, reinforced amalgam, 16, and cast gold, 19 pounds. The reinforced amalgam that was used in this test was examined at the Milwaukee City Testing Laboratory under the microscope to determine the union between the amalgam and the reinforcing plate. Their report was that it was a very good union and would be permanent.

This experiment on actual teeth brought out a problem which we did not have to contend with in the test specimen, but which was present when an attempt was made to apply the same technic to actual tooth conditions, where two or more surfaces of the tooth are involved. To fashion the occlusal reinforcing plate so that it would follow the outline of the cavity at the buccal and lingual wall was not so simple a procedure as it would appear to be. The reinforcing plate would necessarily have to be bent into a curve in these areas, as otherwise it would be too far away from the cavosurface angle to accomplish its purpose. Likewise, to tap the reinforcing plate into this exact position in the amalgam was not so simple or practical a procedure. Tests made by tapping a blunt instrument around the margin of the completed filling revealed the margin in the outer third of the cavity and specially at the cavosurface angles to be the weak point. Here, we have to contend with the factor of shearing stress (Fig. 3). These angles appear to be the one place in which it is necessary to have the reinforcing plate in an exact position to increase the shearing strength; i.e., near the surface of the cavosurface angle and in close contact with the cavity wall.

Likewise, from a practical standpoint, this area is one of the places where as much amalgam as possible must be displaced by the reinforcing plate to prevent the progressive distortion or bulging out of the amalgam from the cavity wall from the action of heat on the mercury content. From a practical standpoint, some simpler method must be sought to take care of the areas adjacent to the cavosurface angle. The outline of the cavity walls in the outer third of the tooth is always a straight line. It appeared simpler to cut a v-shaped piece of the reinforcing material and tap it into the freshly packed amalgam at these points. These v-shaped pieces can easily be forced tight to the cavity wall and just deep enough to allow a thin layer of amalgam to cover it when the filling is completed. Thus, the necessity of

making the occlusal plate fit with any degree of accuracy in the distal or mesial portion of the cavity is completely eliminated, while the v-shaped plates fit the wall outline of any cavity and it is easier to place them in the exact position to best resist shearing force.

This method was tried with the same teeth for models as were used before. The insertion of these plates greatly simplified the procedure. When these fillings were tested by tapping with a blunt instrument and mallet at the cavosurface area, no fractures resulted.

The foregoing tests and experiments left only one part of a compound cavity in which no improvement or increased efficiency had been effected, the region of the gingival seat where amalgam progressively becomes distorted from the action of heat on the mercury content.

When the principles demonstrated earlier in this paper were considered, this condition was easy to remedy. Here, there is no strength factor to deal with, but simply the displacing of the amalgam by a rigid reinforcing plate, which besides displacing the amalgam, forces the remaining amalgam to hug the cavity wall when completed. A reinforcing plate coextensive with but smaller than the gingival seat was used and tapped into the seat after the amalgam had been packed. This procedure can be repeated and one or more plates added to the proximal area, the number depending on the depth of it. Care must be taken not to have a plate too close to the plane of the pulpal wall, at it might interfere with placing of the occlusal plate.

Cavities involving only one surface of the tooth did not present any difficulties as to management (Fig. 4). The principles involved in the construction of a compound filling are applicable to any cavity in the posterior teeth.

These tests led me to try this method in the mouth. Patients were selected who had occlusal buccal, mesioclusal, distoclusal or mesioclusodistal cavities, some of which had been previously filled with amalgam, the entire mesial or distal portion having broken away, leaving amalgam remaining only in the occlusal area. This was removed, but the cavity itself was not changed except for extension buccally and lingually, with beveling of the margins. All cavities were prepared with retention at the occlusal and gingival seat. Buccal and lingual wall retention was employed only at the gingival seat. These cavities were restored with amalgam and reinforcing plates (Fig. 5), as I have previously described, and built up to occlusion. Patients were told that something new was being attempted and that they were to report that the results might be noted. From the marks shown on the occlusal surface, that the fillings were undergoing a severe test was evident, but to date none have fractured, nor have the margins pulled away from the cavity walls. The laboratory tests and experiments that had been made were definitely confirmed in the practical tests that only the mouth itself is capable of making.

It will be observed that the mercury content of a filling constructed as I have outlined would be only one-half of, or less than, the amount in an ordinary amalgam filling, amalgam making up only one-half or less of the completed filling, the remainder being composed of the reinforcing elements, which contain no mercury.

It is a well-known fact that the size of the dovetail cut in the occlusal surface of a tooth to retain a mesioclusal or distoclusal filling must depend a great deal on the strength of the material that is used in the restoration. With a strong material like cast gold, the neck can be quite small. With a weak material like

amalgam, the neck must necessarily be cut wide and deep, to allow for a considerable bulk of material. In other words, additional strength must be supplied by increasing the bulk. This is not a practical procedure in the actual cavity preparation, for several reasons. One is that the wider the neck of the cavity, the greater the difficulty encountered because of the direction taken by the enamel rods. Another is that the ratio of strength increase to mass increase is not high enough with amalgam.

From the procedure outlined in this paper, the area or size of the neck of the dovetail for amalgam fillings can be practically the same as for cast gold, as it will have about the same strength as the inlay at the neck of a dovetail. This conserving of tooth structure is a relief not only to the patient, but also to the operator, as this is the area in which we usually cut sound tooth structure, and the use of burs and stones must be resorted to.

Another fact that must not be overlooked is that amalgam contracts or expands about three times as fast as tooth structure at 20 to 50 C., while silver expands or contracts only about twice as fast during the same temperature range. These figures are from the Bureau of Standards reports. Hence, displacing half the amalgam mass with silver reinforcing plates necessarily reduces the amount the completed filling will expand or contract during temperature changes in the mouth.

From laboratory and actual mouth experiments carried out over a period of three years, I am convinced that amalgam fillings can be constructed in the mouth which will approximate gold inlays as far as strength and general efficiency are concerned. Likewise, I know that it can be done with a minimum amount of effort and expense.

Practical experience has shown that approximately ten patterns or shapes will take care of all the various cavity formations found in the posterior teeth. With reinforcing plates already cut in these patterns, it is a simple matter to select whatever shape or size the cavity requires. What little trimming or bending may be necessary to make the reinforcing plate loosely fit the cavity takes only a minute.

An amalgam restoration with such properties and physical strength as the above-outlined tests show and at practically no expense either as to time or material should have a very definite place in dentistry. The confines of this paper will not permit of a discussion of the economic possibilities that a filling with such properties and strength as outlined opens up to the general practitioner.

Suffice it to say that there never was a time in American dentistry when the need of dependable low cost dental service was more prevalent than at present. Cast gold inlays, though dependable, were not designed for low-cost dental care. The reinforcing of amalgam offers a solution to this problem.

SUMMARY

By the proper reinforcing of an amalgam restoration:

1. The transverse strength, which is the most practical strength test for any filling material, is increased 500 per cent. This brings the transverse strength of reinforced amalgam to practically the same as that of cast gold.

2. The flow of reinforced amalgam is reduced to less than one-half that of plain amalgam.

3. The crushing strength of reinforced amalgam is 80 per cent higher than that of plain amalgam.

4. The increased shearing resistance

of reinforced amalgam filling eliminates failures at the cavosurface angle.

5. The mercury content of a reinforced amalgam filling is only one-half that of an ordinary amalgam filling; also, the amalgam is much better condensed in the reinforced filling.

6. The reinforcing plates become chemically welded into the filling and force the amalgam to hug the cavity wall.

7. The dovetail retention on the occlusal aspect does not need to be cut any wider or deeper for a reinforced amalgam filling than for a cast gold inlay.

8. Expansion and contraction of the reinforced amalgam filling are less than for plain amalgam during mouth temperature changes.

9. No great amount of time nor costly materials are involved in constructing a reinforced filling.

From the comparative tests and experiments outlined in this paper and from discussions had with metallurgists and engineers, I am convinced that the reinforcing of amalgam in dental restorations is even more practical than the reinforcing of concrete in the engineering field.

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DISEASES OF THE MOUTH DUE TO FUNGI*

By VIRGINIA FISHER, Ph.D., Chicago, Ill.

THE yeasts and fungi were among the first organisms to be described in the field of scientific research, early in the seventeenth century. This was due, no doubt, to their comparatively large size, which made them more easily observed than bacteria in the days before the use of the compound microscope. They have continued to play an important rôle in the fields of commerce and science up to the present day.

The part they play as disease-producing entities in the field of clinical medicine, especially dermatology, is recognized in spite of discrepancies in the descriptions of the organisms themselves and confusion concerning their terminology. Recent trends in medical mycology (the study of disease-producing yeasts, molds, and fungi) have been toward simplification of generic names and more adequate descriptions of known species.

Neither the normal nor the pathologic mycologic flora of the oral cavity has been studied to any great extent. Fungous infections of the mouth form a limited group of conditions that usually come first to the dentist's attention. They can be classified as (1) lesions of the mouth and (2) constitutional conditions with oral manifestations.

ORAL DISEASES

Thrush.—Thrush of the mucous membrane of the mouth (mycotic stomatitis) is one of the most important of the local mouth conditions due to fungi. It is a form of stomatitis characterized by the appearance of discrete small opaque white patches on the mucous membrane of the

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cheeks, soft palate and especially the tongue, resembling flecks of curdled milk, which gradually coalesce and form a yellowish gray membrane, which may involve great areas of the oral cavity. The membrane is firmly adherent to the underlying structures and, if it is forcibly removed, bleeding may result. Symptoms of catarrhal stomatitis are always associated with this condition and, in many cases, there are coincident gastrointestinal disturbances. The mouth is, as a rule, the only part affected, but occasionally the lesions spread to the tonsils, pharynx and esophagus.

The cause of thrush is a yeastlike fungus, *Monilia albicans,* first described by Langenbeck,[1] in 1839. The same organism has been variously named by later investigators as *Oidium albicans* (Robin,[2] 1853), *Saccharomyces albicans* (Rees,[3] 1870) and *Endomyces albicans* (Vuillemin,[4] 1899). Recent investigation indicates that *Monilia albicans* is the most logical name from the standpoint of classification, and it is now given preference.

The organism may be demonstrated in direct preparation made by removing the membrane and mounting it in 10 per cent sodium hydroxide on a slide. Microscopic examination will reveal many interlacing mycelia and spores. While the presence of a yeastlike fungus may be determined by direct examination, it should not be concluded that *Monilia albicans* is present unless cultural, morphologic and biochemical characteristics are revealed.

The distribution of the thrush organism in normal mouths has been the subject of several investigations. Epstein[5] (1924) found that 54 per cent of the cultures taken from infants from 2 to 6 weeks of age were positive; while, at 1 year of age, the incidence of positive cultures dropped to 46.5 per cent, with a further decrease to 38.5 per cent up to 6 years of age. Frequently, the same strain was found in the throat cultures of both mother and child. Tanner, Lampert and Lampert[6] (1927) examined the throat cultures of 1,000 students of college age for yeasts and yeastlike fungi, finding 10 per cent positive. This study was not limited to the thrush fungus alone.

The survey of the normal body surfaces carried out in our laboratory (Fisher and Arnold,[7] 1936) indicates that *Monilia albicans* does occur on the apparently normal mucous membranes of healthy persons. The percentage of positive cases that we found is lower in general than that found by Epstein, but higher than that of Tanner *et al.* There seems to be little difference between the age groups. Saliva cultures from 122 adults in a group of medical patients without oral disease showed slight differences in percentage from the throat and tongue cultures previously mentioned, as shown in the accompanying table. (The membrane may be inoculated into honey-agar [6 per cent honey, 1 per cent peptone, 2 per cent agar, adjusted to a p_H of 5.2].) The growth appears in from twenty-four to

1. Langenbeck, B.: Froriep's neue Notizen, 1839, pp. 252-145.

2. Robin, C.: Histoire Naturelle vegetaux parasites qui croisent sur l'homme et sur les animaux vivants, Paris, 1853, pp. 488-513.

3. Rees: Botanische Untersuchungen ueber die Alcoholgarungs-pilze, Leipsic: A. Felix, 1870.

4. Vuillemin, M. P.: Rév. Mycol., 21:43, 1899.

5. Epstein, B.: Studien zur Soorkrankheit, Jahrb. f. Kinderh., 104:129-162 (Feb.) 1924.

6. Tanner, F. W.; Lampert, F. N., and Lampert, M.: Presence of Yeast-Like Fungi in Normal Throats, Centralbl. f. Bakteriol., 103: 94-97 (July 1) 1927.

7. Fisher, C. Virgina, and Arnold, L.: Classification of Yeasts and Yeast-Like Fungi—Isolated from Normal Skin and Mucous Membranes, Univ. Illinois, Coll. Med., Monograph Series, to be published.

forty-eight hours as creamy white conical colonies. This colony characteristic may apply to other yeasts and yeastlike forms so that further varification of species should be made. Inoculation is made into cornmeal agar in the deep stabs, with incubation at room temperature for forty-eight hours. Observation is made *in situ* in the plate and in slide mounts in wet preparation for mycelia, spore clusters and terminal chlamydospores. The organism may be further tested biochemically and should show the following reactions: acid and gas in maltose, and acid only in saccharose, and coagulation of milk. Saprophytic yeasts, yeastlike fungi and molds other than the thrush fungus also occur in normal mouths as part of the endogenous flora.

A study of a histologic section shows that the monilia spores lodge between the epithelial cells and gradually separate the different layers of the oral mucous membrane. This occurs before the formation of the membrane. Later, the lesions extends onto the surface of the mucous membrane and also penetrates the deeper structures. It may invade, and produce thrombosis in, the regional blood vessels, or even be carried to distant parts of the body, giving rise to metastatic foci of infection.

Frost *et al.*[8] (1929), Ravaut and Rabeau[9] (1929) and Hopkins[10] (1932) have described the complications that may arise from untreated cases of thrush—the so-called monoliid reaction. This is the appearance of eczematoid lesions caused by the reaction of sensitized areas of skin to metabolic products of Monilia developed in the local lesion. These eczematoid areas may appear on any part of the skin surface, affecting even the toenails and fingernails. Monilia cannot be isolated from any of these lesions, but the reaction subsides when the oral lesions are effectively treated.

Thrush occurs chiefly in young children. When seen in adults, it is usually associated with debilitating diseases, such as severe anemia. Its control, especially in children's institutions, is essential as it may be spread by contact with utensils used in the mouth and may reach epidemic proportions.

This disease is particularly prevalent in the new-born, in whom it may be due to a variety of conditions. Thrush of the vagina, which is essentially identical to thrush of the mouth, is not an uncommon condition in apparently normal women. Its prevalence is markedly increased during pregnancy. Consequently, children born of mothers with thrush of the vagina may be as liable to contract thrush of the mouth as infants born of mothers with gonorrheal infections to contract ophthalmia neonatorum.

Another factor in the occurrence of thrush is the apparently saprophytic existence of *Monilia albicans* in the normal mouth of children or adults until such time as the physiologic processes are impaired sufficiently by improper diet or intercurrent diseases for the organism to gain a foothold and assume a pathogenic rôle. This may be analogous to conditions in which *Streptococcus hemolyticus* or *pneumococcus* of various types is found in the normal throat and takes advantage of the host under abnormal conditions.

Perlèche.—This is another local mouth condition of fungous origin. It is an af-

8. Frost, K.; Sutherland-Campbell, H., and Plunkett, O. A.: Monilia of Tongue; Report of Instance with Associated Skin Lesions Moniliatid, Arch. Derm. & Syph., 20:811-819 (Dec.) 1929.

9. Ravaut, P.; Rabeau, Langhin, et al.: Recherchez Microbiologiques et humorales concernant les levures chez 137 malades atteints de diverses dermatoses, Bull. Soc. franc de dermat. et syph., 36:607-611 (June) 1929.

10. Hopkins, J. G.: Moniliasis and Moniliids, Arch. Derm. & Syph., 25:599-614 (April) 1932.

fection of the lips, usually bilateral, located at the commissures. The mucous membrane is thickened and appears somewhat macerated. The lesions are most marked on the red border of the lips, but usually extend a short distance onto the true mucous membrane of the mouth and also onto the skin surface. They are limited to the angles of the mouth. The color of the lesions is nearly that of mother-of-pearl. The mild cases show slight wrinkling of the surface. The more advanced ones present deeper wrinkles and often transverse fissures with red bases, easily seen when the membrane is stretched by opening the mouth. These fissures very rarely bleed.

Even in the most marked cases, the disease is strictly local. The extension is in depth rather than laterally. There is no neighboring inflammation, no areola of redness, no lymphangitis and no glandular involvement, even in the submaxillary region.

Perlèche is chiefly a disease of childhood, though it is not infrequently found in adults. Subjective symptoms are very slight or entirely lacking. There is no itching, and children have no tendency to keep carrying the fingers to the lesions, though, in some cases, they continually run the edge of the tongue over them. In the milder cases, there is no abnormal sensation.

To one familiar with the disease, the diagnosis is simple. The only things with which it can be confused are the mucous patches of syphilis. When the condition is mild, the appearance is that of the usual mucous patch. When the lesion is more marked, thickened and fissured, the appearance is that of the so-called "split papule" of the corner of the mouth. There is a difference between the conditions. In perlèche, there is a whitened area of maceration of the epithelium, dry when not moistened with saliva, and, in the sense that it does not ooze, it is adherent and wrinkled; while the mucous patch is due to an erosion, very superficial to be sure, but still a true erosion. Furthermore, perlèche exists alone, with no other signs, and the mucous patch in this location is always attended by some other signs of syphilis. Cracks and fissures of the lips at the angles of the mouth have a totally different appearance. Perlèche is highly contagious, often affecting a whole family and frequently spreading widely in a school.

The etiology of perlèche is questionable, but the majority of investigators consider it due to a yeast or fungus. Finnerud[11] (1929) cultivated a yeastlike organism from eighty-two of 100 cases of perlèche. He could experimentally reproduce the disease in human beings. Skolnik[12] (1930) found cryptococci present in each of five cases of perlèche. Frank[13] (1932) isolated moniliae from four similar cases. Thirteen of twenty-two perlèche cases cultured by Robinson and Moss[14] (1932) yielded *Monilia albicans*. While the organisms named as possible etiologic factors in the perlèche lesion varied, it is possible that less discrepancy exists than seems apparent. The reason for this is the lack of standard methods in the past for the diagnosis of these organisms. Five of six cases of perlèche that I cultured yielded *Monilia albicans*. The fact that no *Monilia albicans* was found in cultures taken from the commissures of seventy-six normal persons,

11. Finnerud, C. W.: Perlèche—Clinical and Etiologic Study of One Hundred Cases, Arch. Derm. & Syph., 20:454-488 (Oct.) 1929.

12. Skolnik, E. A.: Perlèche of Adults, Arch. Derm. & Syph., 22:642-646 (Oct.) 1930.

13. Frank, L. J.: Perlèche in Adults, Arch. Derm. & Syph., 26:451-455 (Sept.) 1932.

14. Robinson, L. B., and Moss, M. C.: Superficial Glossites and Perlèche Due to Monilia Albicans, Arch. Derm. & Syph., 25:644-654 (April) 1932.

although other types of yeast could be isolated, and the fact that it does appear frequently in the perlèche lesion is further evidence that this organism is the etiologic factor.

Glossitis.—A third condition due to *Monilia albicans* is a superficial glossitis frequently associated with cases of perlèche. Various authors have described cases of glossitis that assume various clinical aspects. Robinson and Moss[14] (1932)

EXPERIMENTAL DATA

	Children 2 Months to 16 Years	Adults 20 Years and Over
Total Number of Cases	48	28
Throat		
Number positive for all types of fungi	19	14
Positive for all types of fungi	39.5%	50%
All cases positive for M. albicans	25%	21.4%
Tongue		
Number positive for all types of fungi	6	3
Positive for all types of fungi	20.8%	21.1%
All cases positive for M. albicans	12.5%	10.7%
Saliva, number of cases	....	122
Number positive for all types of fungi	....	55
Positive for all types of fungi	....	45.1%
All cases positive for M. albicans	....	26.2%

describe several cases of glossitis due to *Monilia albicans,* as follows: The lesion, when of recent origin, gives some discomfort, such as burning or soreness, mostly when food is taken. The more chronic cases are apparently free from symptoms. In chronic cases, the surface of the tongue is most striking, there being apparently a complete loss of papillae. The tongue presents a smooth slippery appearance, similar to that of a piece of red rubber recently moistened. In less advanced cases, there are plaques of this description, mostly on the anterior half of the tongue. These smooth atrophic lesions bear no resemblance to the familiar thrush patches due to *Monilia albicans.*

Other clinical manifestations of glossitis due to the same organism have been described by Zeisler[15] (1927) and Frost *et al.*[8] (1929). Zeisler's case showed white scrolllike patterns on the tongue surface. In Frost's case, the tongue was deeply fissured and covered with a gelatinous membrane.

The local conditions of the mouth due to fungi include, then, thrush of known etiology, perlèche and glossitis of doubtful etiology, but probably due to the same organism. Further corroboration of the *M. albicans* theory lies in the fact that patients affected with perlèche or glossitis or both frequently have paronychia and erosio interdigitalis blastomycetica, skin lesions of the hand definitely known to be caused by that organism.

GENERALIZED CONDITIONS WITH MOUTH LESIONS

In addition to these lesions produced by the monilia are a few conditions produced by the actinomyces and related fungi, the leptothrix or streptothrix.

Actinomycosis.—Actinomycosis, while it may affect any and all parts of the body, has a predilection for the head and neck, especially the bone or the jaw, the tongue or the salivary and lymphatic glands of the neck. The affected portion becomes enormously swollen and filled with sinuses, which exude quantities of pus containing many granules. These yellowish granules, when pressed under a cover glass, show the so-called ray

15. Zeisler, H. P.: Monilia Infections of Tongue, Arch. Derm. & Syph., 15:171-185 (Feb.) 1927.

fungus with clubbed ends. The onset is insidious and the patient usually comes to the dentist with the belief that he is suffering from an alveolar abscess, although by this time the bone is usually involved. The prognosis is usually grave, as metastasis to other parts of the body occurs.

Leptothrix.—Diseases due to the leptothrix are rare, but it has been suggested that *Leptothrix buccalis* may produce an inflammation of the pharynx, with white patchy exudation and painful deglutition. Castellani[16] (1920) has also described granular leptothrix of the crypts of the tonsils, which may lead to the formation of tonsillar calculi. The affection runs a chronic course and is not painful. It is usually observed in the mouths of nonsmokers. The patient frequently consults the dentist because of unpleasant breath. The teeth and gums may be quite healthy, but, on examination of the throat, small whitish or yellowish spots will be seen on the tonsils; these spots are, in reality, the surface portion of granules contained in the crypts, and may be extracted with more or less ease. If untreated, calculi may develop and produce inflammation. The bodies, when mashed, have an offensive odor. Under the microscope, they are seen to consist of masses of leptothrix filaments. The organism is difficult to cultivate.

Of interest also are a group of diseases caused by fungi, frequently generalized throughout the whole body, but also capable of producing oral disease such as sporotrichosis, blastomycosis and coccidiodal granuloma.

Sporotrichosis.—Sporotrichosis (de Beurmann and Gougerot[17] [1909], caused by the fungus, *Sporotrichum schenskii,* is an infectious granulomatous disease of fungous origin, invading at times any and all tissues of the body. Because of its wide distribution, mode of infection and production of great disability, it is of considerable economic importance; and because of its clinical polymorphism, especially a similarity to syphilis and tuberculosis, knowledge of it is of value. Cases appear in all parts of the world, but the majority appear in the Mississippi valley. It is disseminated throughout the body via the lymphatics in some cases, the hematogenous route in others. In still others, it may remain local. Diagnosis depends on cultivation of the sporotrichum, as it is usually impossible to demonstrate the organism in material taken directly from the lesions. While primary isolated mucous sporotrichosis of the pharynx and the larynx without association with a disseminated sporotrichosis is unknown, the disease is still of interest to the dentist because the mouth lesions may persist for a long time after all other symptoms have completely disappeared. The oral condition may take on various clinical pictures. Pharyngeal ulceration, laryngitis, vegetative stomatitis, loss of voice and painful deglutition may result. The affected areas are usually covered with powdery material or papillomatous vegetation which is hard to detach, but from which the organism may be readily cultivated on suitable mediums.

Blastomycosis.—Blastomycosis (Benham,[18] 1934), produced by *Blastomyces dermatitidis,* may be divided into two clinical entities, one confined to the skin, the other generalized or systemic. The disease, in either instance, runs a long chronic course, the prognosis in the former instance being good. In the latter,

16. Castellani, Aldo, and Chalmers, A.: Manuel of Tropical Medicine, New York: William Wood and Co., 1920, pp. 1747-1748.

17. DeBeurmann, L., and Gougerot, H.: Les Sporotrichoses, Libraire Felix Alcan, Paris, 1912, pp. 314-319.

18. Benham, R. W.: Fungi of Blastomycosis and Coccidioidal Granuloma, Arch. Derm. & Syph., 30:385-400 (Sept.) 1934.

the outcome is fatal. The systemic type usually affects the lungs early in the disease and oral disease follows. Lesions of the larynx, tracheobronchial lymphadenitis and peritonsillar abscess may result. Diagnosis may be made as a rule by direct examination of the pus in sodium hydroxide mounts, and also by culture.

Coccidioidal Granuloma.—Coccidioidal granuloma, caused by *Coccidioides immites,* may exhibit such a variety of clinical forms that it is impossible to give any one description to fit the lesions produced. Most of the 120 cases on record have developed in persons residing in the San Joaquin valley in California. The disease is usually fatal. The primary lesions occur frequently on the head and neck, with involvement of the mucous membranes of the nose and mouth. Diagnosis is made by demonstration of the organisms in direct mounts and cultivation as for blastomyces. Any and all parts of the body may become affected, but experience with cultures of the *Coccidioides immites* in the laboratory indicated that infection may arise by inhalation through the nose and mouth, as cases in a milder form have developed in laboratory investigators who have handled the cultures without the precaution of a mask.

SUMMARY

Yeasts, yeastlike fungi, fungi and molds occur on the mucous membranes of the mouth in both normal and pathologic conditions. Many of these are saprophytic, but some may become pathogenic under suitable conditions. Local lesions may consist of (1) thrush, due to *Monilia albicans,* (2) perlèche and (3) glossitis, probably caused by the same organism, and (4) granular leptothrix of the crypts of the tonsils, leading to formation of calculi, caused by the presence of a species of leptothrix. The generalized conditions with local manifestations are more rare and consist of: (1) actinomycosis, (2) sporothrichosis, (3) blastomycosis and (4) coccidioidal granuloma.

DENTAL FINDINGS IN THREE HUNDRED EIGHTY-FIVE BLOOD DONORS

By the Committee on Community Dental Service of the New York Tuberculosis and Health Association*

FOREWORD

THIS report, as far as it refers to correlation between dental conditions and blood types, is a straw in the wind, submitted with the full realization that 385 cases, no matter how indicative, are an insufficient total on which to base conclusions as to the relationship between dental conditions and blood types. It is therefore hoped that while the committee continues research, other groups, with a like opportunity to study the dental condition as related to blood type, will add the weight of their findings to the evidence in this important health field. The second conclusion, that persons with diseased teeth and gums are not suitable donors of blood for transfusion to disease or injury weakened recipients, is in no sense debatable, and merits prompt in-

*John T. Hanks, Chairman.

corporation in the standards regulating professional donation of blood in sickness.

A statistical analysis of dental conditions in 385 registered blood donors in the city of New York has just been completed by the Committee on Community Dental Service of the New York Tuberculosis and Health Association. The study was undertaken late in 1934 as a result of a conversation between Alfred Walker, then chairman of the committee, and John L. Rice, commissioner of health. Dr. Rice expressed an interest in the probable values of such a study, and offered the cooperation of the department of health.

Harry Strusser, D.D.S., chief of the division of dental service of the department of health, accepted appointment as a subcommittee of one from the Committee on Community Dental Service to direct the study. Examinations were made at the Department of Health by Dr. Strusser, assisted by H. S. Dwyer, D.D.S., and charts were analyzed at the New York Tuberculosis and Health Association by Pauline Warner, assistant secretary, and Ann dePalma, statistical clerk.

There are three codes used in classifying blood types. These codes or systems, known as International, Jansky, and Moss, are coordinated in Table 1.

Todd, in his section on the isohemagglutination groups,[1] explains the necessity of the four groups thus: When transfusion is undertaken, the blood should be secured from a person belonging to the same group as the patient. If such a donor cannot be found, International O (Jansky 1, Moss 4) is the universal donor; i.e., can give blood to any of the four, and likewise International AB (Jansky 4, Moss 1) is the universal recipient. In the present study, the International code is used for designating the four groups.

There were 2,707 registered blood donors in the City of New York in 1935. This study of dental conditions includes 385 cases, covering 14 per cent of the city's blood donors. Although cases were unselected and taken in the order in which they came in, the percentage of each group represented was approximately the same as the percentage for the

TABLE 1.—CLASSIFICATION OF BLOOD DONORS

International O = Jansky 1 = Moss 4 = universal donor
International A = Jansky 2 = Moss 2
International B = Jansky 3 = Moss 3
International AB = Jansky 4 = Moss 1 = universal recipient

TABLE 2.—BLOOD TYPES BY PERCENTAGE

International	General Population	New York City 1935 Donors		Donors Studied	
Blood Type	Per Cent	No.	Per Cent	No.	Per Cent
O	43	1198	44	183	47
A	40	1047	39	146	38
B	7	355	13	37	10
AB	10	107	4	19	5
All Types	100	2707	100	385	100

1. Todd, J. C.: Clinical Diagnosis by Laboratory Methods, Philadelphia: W. B. Saunders Co., 1924, pp. 351-357.

total registered blood donors, and also that estimated as occurring in the general population, as shown in Table 2.

(*a*) Blood type
(*b*) Blood type and age

2. Incidence of dental caries and presence of fillings (exclusive of cases of badly decayed, nonsavable teeth, to be extracted)

TABLE 3.—DENTAL FINDINGS BY BLOOD TYPES IN 385 BLOOD DONORS

Type			O	A	B	AB	All Types
Age (median, years)			39.5	34.5	37.0	42.0	39.5
Total cases			183	146	37	19	385
Caries	Teeth	No.	276	269	74	34	653
		Av.	1.51	1.84	2	1.79	1.70
	Surfaces	No.	350	354	108	43	855
		Av.	1.91	2.42	2.92	2.26	2.22
Fillings	Teeth	No.	800	660	170	75	1705
		Av.	4.37	4.52	4.06	3.95	4.43
	Surfaces	No.	1156	931	242	98	2427
		Av.	6.32	6.38	6.54	5.16	6.30
Total caries and fillings	Teeth	No.	1041	892	238	104	2275
		Av.	5.69	6.11	6.43	5.47	5.91
	Surfaces	No.	1506	1285	350	141	3282
		Av.	8.23	8.80	9.46	7.42	8.52
Nonsavable teeth		No.	90	78	21	16	205
		Av.	0.49	0.53	0.57	0.84	0.53
	Surfaces*	No.	270	234	63	48	615
		Av.	1.48	1.60	1.70	2.53	1.60
Missing teeth†		No.	1197	999	213	102	2511
		Av.	6.54	6.84	5.76	5.37	6.52
	Surfaces*	No.	3591	2997	639	306	7533
		Av.	19.62	20.53	17.27	16.10	19.57
Total nonsavable and missing	Teeth	No.	1287	1077	234	118	2716
		Av.	7.03	7.38	6.32	6.21	7.05
	Surfaces*	No.	3861	3231	702	354	8148
		Av.	21.10	22.13	18.97	18.63	21.16
Total affected teeth		No.	2328	1969	472	222	4991
		Av.	12.72	13.49	12.76	11.68	12.96
Total affected surfaces		No.	5367	4516	1052	495	11430
		Av.	29.33	30.93	28.43	26.05	29.69
Percentage of destruction‡			18.125	19.375	17.5	16.25	18.75

*Estimated three surfaces of destruction per nonsavable or missing tooth.
†561, or 22.33 per cent, replaced.
‡Bödecker Dental Caries Index.

The 385 cases examined were studied for the following facts:

1. Cases with caries and/or fillings

(*a*) Blood type
(*b*) Blood type and age
(*c*) Blood type and nativity

3. Incidence of nonsavable teeth (badly decayed teeth, to be extracted, not included in caries study)
(*a*) Blood type
(*b*) Blood type and age
(*c*) Blood type and nativity

5. Teeth previously extracted, replaced and unreplaced
(*a*) Blood type
(*b*) Blood type and age
(*c*) Blood type and nativity

TABLE 4.—BLOOD TYPE, AGE AND DENTAL DESTRUCTION

Type	Age		Dental Destruction	
	Years	Variation from Average	Per Cent	Variation from Average
O	39.5	0.0	18.125	—0.625
A	34.5	—5.0	19.375	+0.625
B	37.0	—2.5	17.500	—1.250
AB	42.0	+2.5	16.250	—2.500
Average	39.5		18.75	

TABLE 5.—DENTAL FINDINGS BY AGE GROUPS IN 385 BLOOD DONORS

Age group		20-24	25-29	30-34	35-39	40-44	45-49	50+	Unknown	All Ages
Total cases		84	134	63	61	31	9	1	2	385
Total affected teeth	No.	931	1,581	815	955	504	182	17	6	4,991
	Av.	11.080	11.800	12.940	15.660	16.260	20.220	17	3	12.960
Total affected surfaces	No.	1,760	3,384	1,850	2,470	1,411	506	37	12	11,430
	Av.	20.950	25.250	29.370	40.490	45.520	56.220	37	6	29.680
Percentage of destruction		13.125	15.625	18.125	25.000	28.750	35.000	23.125	3.750	18.750

TABLE 6.—DENTAL FINDINGS BY NATIVITY IN 385 BLOOD DONORS

Nativity		American	European	All Nativities
Age (median, years)		32.00	37.00	39.50
Total cases		291	94	385
Total affected teeth	No.	3,794	1,197	4,991
	Av.	13.04	12.73	12.96
Total affected surfaces	No.	8,587	2,843	11,430
	Av.	29.50	30.24	29.68
Percentage of destruction		18.125	18.75	18.75

(*a*) Blood type
(*b*) Blood type and age

4. Missing and nonsavable teeth
(*a*) Blood type
(*b*) Blood type and age

6. Summary of replacements: blood type and age
7. Gum condition: blood type
8. Mouth hygiene: blood type

In a recent publication, Bödecker de-

scribes a method for obtaining the dental caries index.[2] Caries, treated and untreated, is counted by surfaces. A tooth lost through caries is counted three surfaces; a completely destroyed crown, five surfaces; a tooth serving as a bridge abutment, two surfaces. No count is given for teeth lost through pyorrhea, as the purpose is to indicate tooth destruction by caries only. In the adult dentition, the five surfaces of thirty-two teeth provide a total of 160 surfaces. A table of percentage is presented so that any number of affected tooth surfaces may be expressed as a percentage of the total number of surfaces.

The summary of dental findings by blood type (Table 3) utilizes the Bödecker Dental Caries Index in order to afford a basis of comparison for the four groups studied. The resulting percentages of tooth destruction are conservative, as all nonsavable and missing teeth are counted as three destroyed surfaces each, instead of four or five, and as no count is given to bridge abutment teeth, which usually represent at least two destroyed surfaces.

A brief comparison of average age and dental destruction in the four blood types indicates the apparent superiority in dental condition of Type AB, where the age is 2 years 6 months above average of all cases studied, and the dental destruction is 2.5 per cent below average. (Table 4.)

Table 5 shows the percentage of destruction by age groups. A progressive increase in destruction of dental tissue is indicated from age 20 to 44. Above 45 years, there are too few cases to warrant conclusions.

In Table 6, dental findings in American-born are compared with those in foreign-born donors. Countries of nativity included Armenia, Canada, Czechoslovakia, Denmark, England, Esthonia, France, Germany, Holland, Hungary, Ireland, Italy, Lithuania, Norway, Poland, Spain, Sweden, Ukraine, Russia and Austria. There is a slight difference in dental destruction of American-born as compared with foreign-born, the small variation being in favor of American-born. In this consideration, it must not be overlooked that the median age of the American-born group is five years less than that of the foreign-born group. The gum condition was charted in the dental examination only where it was remarkably good or remarkably poor. While the results are negligible from any statistical point of view, including only seventy-two cases, it is noteworthy that the gum condition was in no case charted for a member of Type AB. Of all cases, 7.3 per cent showed extremely poor gum condition.

Mouth hygiene was charted in only 180 cases; 52.6 per cent of Type AB showing a good oral condition, while other groups showed under 19 per cent having good daily dental care.

CONCLUSIONS

The most significant and important conclusion reached is that no person with a diseased mouth should be considered eligible to act as a blood donor.

The dental examiners are impressed with the evidence that a great many of the blood donors examined present mouth conditions not only detrimental to their own health, but also possibly to their donated blood elements, i.e., bacterial organisms or toxic substances, which may be potential hazards to the recipients. The recipient of a blood transfusion, always in a condition with lowered resistance to disease, may be susceptible to secondary infection when the blood of the donor carries such germs or toxic substances. Of the donors examined, many

2. Bödecker, C. F.: Results of Dental Caries Index, D. Survey, 12:26 (Feb.) 1936.

showed active gingivitis and pyorrheic infection, with oozing pus pockets, badly decayed teeth and infected roots and sinuses.

Although there is at present a controversy concerning elective hematogenous localization of foci of infection, the possibility of the ultimate truth of the contention (Rosenow's) certainly does not warrant the exposure of the recipient of transfusions to the dangers of disease-bearing blood. Further study as to effects on recipients should be considered, as well as a change in the rules and regulations governing the health standards of donors.

A second conclusion is that a greater number of Type AB should be studied, in order that the apparent marked superiority in dental condition of this group may be substantiated or discounted. Probable error (a universally accepted statistical method for determining the significance of the differences between the averages of two or more groups of numerical data) computed for Type B and Type AB failed to show that these groups differ significantly from Type O and Type A. Examination of a total of at least 1,000 cases of all types, the results to be modified by consideration of probable error, would make it possible to theorize on the differences in dental condition inherent in blood types. In the meantime, it is hoped that corroborative research will be carried on by other groups in other cities, in order that statistically conclusive data may be available for the consideration of the dental condition in relation to blood types.

SURGERY OF THE SOFT TISSUES OF THE MOUTH*

By DON E. WOODARD, D.D.S., M.S.D., Kansas City, Mo.

IN the treatment of the soft tissues of the mouth, technic is often neglected, under the stress of removing teeth from the osseous structures.

It is my desire to present four procedures in soft tissue management through which better results may be attained in the shape, contour and stability of the edentulous alveolar ridge. We must never lose sight of the fact that not only is it our problem successfully to perform and complete an operation, but also our operative area will eventually have a service to perform for that patient and we should anticipate and prepare for eventual artificial restorations. If we overlook this fact, no matter how successfully we handle the immediate complaint, we are not fulfilling our obligation to the patient, the dentist or ourselves. The possibilities for improvement in this phase of our work are tremendous, and the technics herein described and illustrated are a step in this direction.

The technic of alveolectomy has changed little in the last fifteen years, and yet, during all this time, we have overlooked fundamental factors in soft tissue surgery, neglect of which has frequently interfered with results.

Plastic surgery need not be confined to esthetics, because, by its principles, we can improve the quality of our work and assure greater satisfaction to our patients.

*Read before the Section on Oral Surgery, Radiology and Anesthesia at the Seventy-Second Annual Midwinter Clinic of the Chicago Dental Society, Feb. 19, 1936.

THE FOUR PROCEDURES

1. *Tissue Treatment in the Removal of Isolated Teeth.*—In cases of simple removal of individual isolated teeth, tissue and ridge deformity frequently results. Absorption and atrophy, whether normal or from tissue-bearing prostheses, have taken place in adjacent edentulous areas, and there is a bulge in the mucosa and

Fig. 1.—Tissue treatment in removal of isolated teeth.

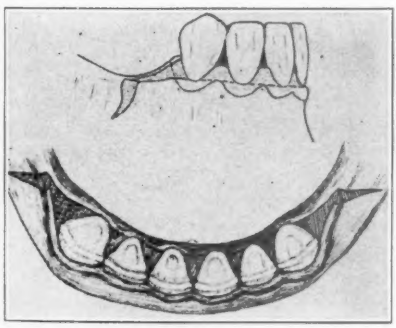

Fig. 2.—Flap design for surgical removal of lower six anterior teeth.

osseous structure about the remaining tooth. If this is left untreated, the resultant ridge is irregular and the success of an immediate artificial denture is unlikely. The area is prominent, and when a restoration is made, is frequently the source of irritation and complaint. This irregularity can be so easily corrected at the time of the extraction of the tooth, and this correction will provide for the more rapid healing of the socket (because it is partially collapsed), the immediate insertion of artificial dentures and, eventually, a smooth, regular ridge.

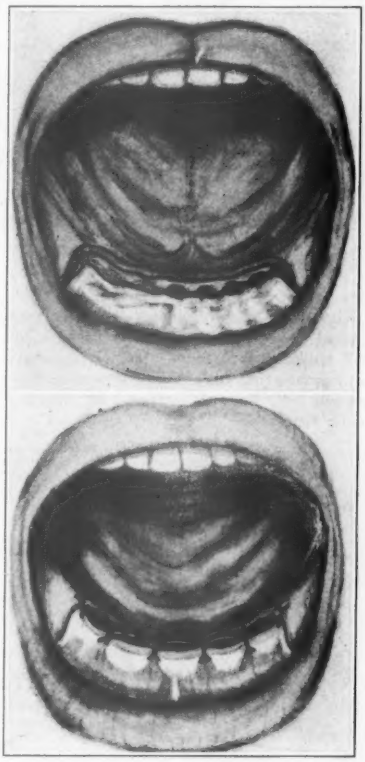

Fig. 3.—Above, ridge smoothed; below, flap sutured.

Technic (Fig. 1): An incision is made in the mucosa beginning at the mesiobuccal angle of the tooth and extending forward and medially about one-fourth inch to the crest of the ridge. This is joined by a like incision extending forward from the mesiolingual angle, and

the triangular section of tissue so outlined is removed. This procedure is repeated, the incision extending distally from the socket.

The oval opening in the mucosa thus becomes an ellipsis. The edges are undermined and the irregularity of the osseous structure eliminated. If it is necessary to remove the tooth surgically, the incisions may be made before removal and an additional incision may be extended from the anterior apex downward into the buccal fold.

Two sutures are then placed at the approximate edges of the socket. The resultant ridge is smooth in contour and the socket is partially collapsed; which reduces healing time. Tissue-bearing appliances can be immediately placed, as

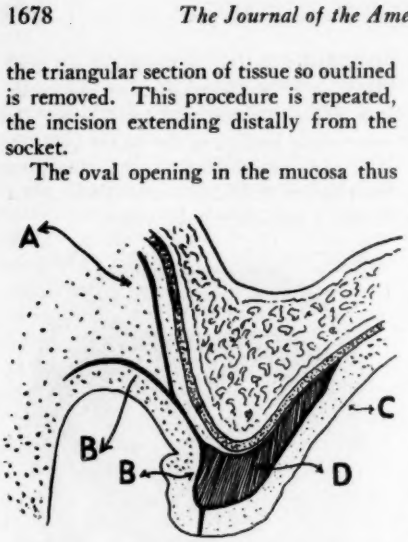

Fig. 4.—Cross-section of upper alveolus; typical flabby ridge with low buccal sulcus and muscle attachments. *A*, incision extended over periosteum high up on buccal surface of maxilla; *B*, line of incision; *C*, palate; *D*, tissue removed.

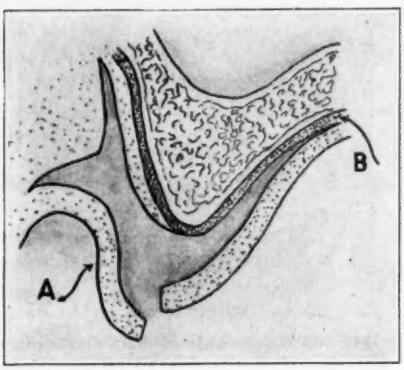

Fig. 5.—Mucosa dissected from periosteum and excess flabby tissue removed. *A*, flap raised; *B*, periosteum.

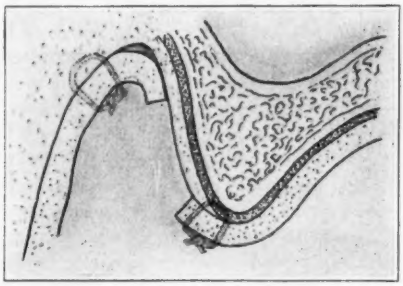

Fig. 6.—Flap folded into made sulcus and sutured to cheek; palatal flap; sutured to periosteum on ridge.

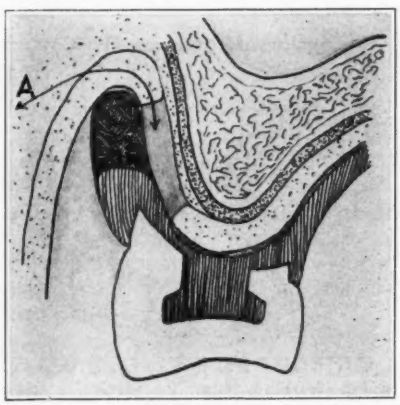

Fig. 7.—Cross-section in case in which old denture was used as splint and buccal flange built up with compound. *A*, compound trimmed out to relieve pressure. The splint in such a case must be worn continuously.

the flanges are on a solid foundation and the healing of the tissue will usually follow the established contour.

2. *Flap Designs in Multiple Continuous Operations on Anterior Teeth to and Including the First Molar (Figs. 2-3).* —Being dissatisfied with accepted flap designs in this type of surgical removal, I attempted to design a flap to overcome: (1) the hump in the ridge and the tissue at the distal extremities of the operative field; (2) the excess of linear-labial tissue resulting from the removal of undercuts, and (3) the tendency of the lateral mucobuccal incision to be unsupported by table bone when trimming is completed.

The design here presented eliminates these three unsatisfactory conditions.

Fig. 8.—Cross-section through upper bicuspid region. *A*, muscle attachments; *B*, cheek; *CC*, depth of buccal fold. Tissue is elastic and, when a flap is raised, a certain amount of shrinkage takes place.

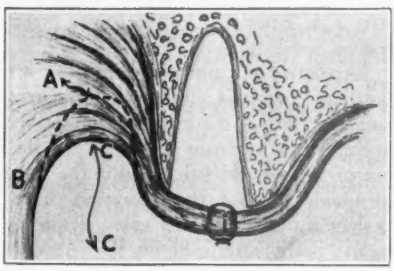

Fig. 9.—Usual trimming and suturing of flaps; showing lowering of buccal sulcus. *A*, former level; *B*, cheek; *CC*, lowering due to suture tension, tissue sliding and contracting and infiltration, with resulting loss in denture area and stability.

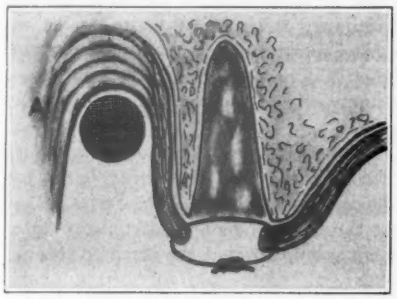

Fig. 10.—Use of finger or round retractor (*A*) in buccal fold to hold tissue up in place while suturing. The suture must not be tight. It is placed to keep the flaps in position and not to draw them together.

Fig. 11.—Modeling compound splint or denture in place with flange built up. *A*, built-up flange.

As in the former treatment of isolated teeth, triangular incisions are made distally from the last tooth in the operative field. From the apex of these triangles, incisions are made gingivally into the buccal fold.

At the completion of the labial osseous trimming, excess linear tissue can be removed in triangular sections from the labial flap at the extremities to facilitate adaptation and overcome flabbiness of the ridge.

3. *New Technic of Mucobuccal Soft Tissue Treatment in Conjunction with Alveolectomy (Figs. 8-11, Series 1).*—At the beginning of this article, a statement was made that the accepted technic of alveolectomy has, for fifteen years, overlooked fundamental facts in soft tissue surgery, this oversight having consistently defeated the purpose of the technic. These are:

Fig. 12.—Correction of flabby ridges.

(*a*) Epithelial tissue with its underlying structure, is elastic and, on being severed, contracts and gapes. (*b*) Because of its loose attachment to the underlying structure, it may be caused to slide in its relationship to this structure. (*c*) Suture tension can and will hold it in this new position until healing takes place. (*d*) Inflammatory reactions, scar and fibrous tissue formation, can cause it to change its original contour.

Heretofore, no definite consideration of these facts and their influence on the end-result of the operation of alveolectomy has been presented. It is an easily demonstrable fact that, unless controlled, these conditions adversely affect the retention of artificial dentures, which depend on atmospheric pressure as a factor in their stability. The improvement noted in the end-results in those cases in which the corrective procedures have been carried out, over that in which these factors were not recognized, has been exceedingly gratifying.

When the mucobuccal flap is raised to facilitate the removal of the buccal plate, contraction of the flap takes place, owing to the elasticity of the tissue, and the flap is consequently shortened in its occlusal-gingival measurement. When the flap is raised very frequently, the muscle attachments are likewise loosened and, in suturing, a sliding of the mucosa is noted, bringing the muscle attachments nearer the crest of the ridge. Suture tension increases this displacement and, at the completion of the operation, the operator is frequently surprised to note that the buccal fold is much more shallow than it appeared to be with the teeth in place. It not only appears so, but it is so, oftentimes by one third of its previous depth. This frequently occurs in buccal flaps turned for the removal of only a few teeth or the removal of healed-over root tips, especially in the lower molar region.

Furthermore, unless measures are taken to correct it, inflammation, edema and the fibrous tissue formation of the healing process cause a further shortening of this buccal sulcus until the commendable idea of the operation of alveolectomy has, in many cases, made the mouth practically unfit for the reception of artificial dentures. To correct these unsatisfactory features, several modifications of the accepted technic must be employed:

(*a*) When the mucobuccal flap is raised, it should be dissected loose from the underlying bone to a higher level than formerly employed to allow for later

molding and deepening of the sulcus. (*b*) After the osseous trimming is completed and the operative area is ready for closure by suturing of the flaps, the second important problem is encountered. Heretofore, the flap has been sutured with little or no consideration of the displacement of the mucobuccal fold. With the index finger or a smooth round retractor, the mucobuccal fold is depressed and deepened as far as possible. It is then seen that the buccal and lingual flaps do not come into apposition, but are separated from one-sixteenth to one-fourth inch, this depending on the amount of trimming and the individual case. Sutures are then placed to prevent the flap from folding or being pushed upward in following out the later technic, but are not used to draw the flaps any closer together. (*c*) Baseplate and modeling-compound splints or treatment dentures previously made are then inserted, and the buccal flanges are built up in modeling compound to maintain the depth of the buccal sulcus and hold the flaps in position. When the entire periphery of the splint covering the operative field is so treated, it is sterilized in alcohol and inserted, and the patient is instructed to leave it in place until seen again, in twenty-four hours. At that time, the splint is removed and cleaned, the mouth thoroughly irrigated with physiologic sodium chloride solution and the splint sterilized and replaced. This splint is worn until all tenderness is gone; when it is replaced by a treatment denture or the treatment denture is relined. Frequently, it is not advisable to operate on an entire arch at one time. In fact, this is seldom done. The posterior teeth are usually removed at one sitting and partial splints are used. When the anterior teeth are removed at a later date, the foregoing technic is carried out. It is important that splints be worn continuously until the denture is constructed, as contraction is a factor in healing and must be controlled as much as possible.

4. *Surgical Correction for Flabby Ridges or Low Muscle Attachments, Wherein the Patient Is Unable to Wear Dentures Satisfactorily. (Figs. 4-7).*— Frequently, cases are observed wherein denture service has been unsatisfactory or impossible owing to various conditions: (1) alveolectomy performed with faulty technic, as pointed out; (2) low muscle attachments in the maxilla and high muscle attachments in the mandible; (3) the presence of flabby ridges, especially in the anterior region; usually seen in the upper jaw and most frequently due to the wearing of an upper denture articulated only against the lower anterior teeth, and (4) atrophic changes in the ridge.

Very often, improvement can be promised patients afflicted with one of these unsatisfactory conditions through surgical intervention. Extensive atrophic change in the alveolar ridge is the one condition in which little can be done, especially in the lower jaw.

Technic: Because flabbiness of the ridge is the most common condition encountered, the technic for its correction in the upper jaw will be outlined. For the other conditions, the technic, of course, must be modified to suit the individual case. Because of the time consumed during the operation, it is advisable to handle these cases under local anesthesia and with premedication.

An incision is made through the mucosa just buccally and labially from the crest of the ridge, from tuberosity to tuberosity. (Fig. 12.) The mucus membrane is dissected free from the excess tissue in the anterior region down to the periosteum. The dissection is then carried upward, freeing the mucosa and attachments from the periosteum high up

the buccal and labial plate to beyond the height the buccal fold is eventually to be. (Fig. 8.)

This is then extended distally to the tuberosity, if necessary. It is frequently advisable also to dissect the mucus membrane from the cheek tissue a short distance to facilitate folding the flap. (Fig. 9.) The depth of the dissection is, of course, limited by the length of the flap. If the attachments are so low that the flap will not be sufficient, the incision may be placed farther lingually to increase its length. The flap so made is next folded into the made crevice and sutured high up in the crevice to the tissue of the cheek. (Fig. 10.) The excessive flabby tissue is then dissected free from the palatal mucosa and removed, and the palatal flap is sutured to the periosteum as far over the ridge as possible.

This will leave a portion of the labial surface of the ridge devoid of mucus membrane, which will epithelize in the healing process. The splint or denture is then carried to the mouth and the buccal flange is built up with modeling compound to completely fill the made buccal fold. The modeling compound must be rounded on all extremities and firmly fixed to the splint or denture. The portion overlying the exposed periosteum of the labial plate is slightly trimmed to allow space for granulation and epithelization.

This operative procedure provides: (1) a deeper buccal sulcus for more stability of the denture; (2) higher muscle attachments, with less interference, and (3) the eradication of the flabby ridge.

In those cases wherein previous denture service has been a failure owing to the conditions mentioned, this operation will, in many cases, provide denture stability and assure satisfaction of the patient. Figure 12 shows one of many practical cases in which this treatment was carried out with excellent results.

1625 Professional Building.

AMALGAM RESTORATIONS*

By F. J. VINER, Omaha, Nebr.

AMALGAM, as a restorative material for lost tooth structure, is, no doubt, the most used and the most abused of all the filling materials. It is most used because of the cheapness of the material itself, and, secondly, because of its apparent easy manipulation. In most dental practices, more fillings are made with amalgam than with all other materials combined. On the other hand, we can truthfully say that it is the most abused, because the greater number of practitioners refer to it as merely amalgam, considering it as a common filling material, that requires little if any technic in its application. There is no other material with which so much careless work is done; neither is there any material that lends itself so completely to careless work. Good and serviceable restorations can be made with amalgam, but not cheaply, as we usually use the term. It will cost as much in conscientious labor and time as it does to make a gold inlay.

*Read before the Section on Operative Dentistry at the Seventy-Second Annual Midwinter Clinic of the Chicago Dental Society, Feb. 19, 1936.

We think that amalgam, as a tooth preserver, under proper manipulation, is second only to gold foil. Since it is used so much, why not use it conscientiously and intelligently?

Perhaps the stigma attached to amalgam has been the result of its introductory use to the profession. Coming from abroad, as it did about the year 1833, with great claims, the profession believed that it must be good and took to it with great gusto, much to their sorrow and the sorrow of the unfortunate patient. Only a few years after its introduction, the so-called amalgam war started, and it was considered malpractice to place an amalgam filling. The controversy raged to such an extent that men were asked to resign from dental societies for using it. It was not until 1895, when that greatest of all dental scientists, G. V. Black, who, through his untiring research and investigations with alloys, gave to us the formula for a balanced amalgam alloy, that we emerged from the dark ages in regard to this material. From that time forward, we find a steady improvement and refinement in the alloys manufactured, and today we have some unusually high-grade products. The manufacturer has continued to improve on the specified refinement of the material, but it does seem that the profession as a whole has unfortunately not proportionately advanced in the scientific use of this material.

To make anything well requires a comprehensive knowledge of the raw material used combined with a technical skill that will produce the desired result. Very few of us have the necessary equipment, time or even ability to obtain first-hand knowledge through experimentation, but the information is available through publications of scientific workers in this field. Moreover, the diligent application of fundamental principles and attention to detail will increase one's technical skill. If men would combine these two precepts and apply them understandingly in the making of amalgam restorations, the resultant product would be one that any one could be proud of.

William E. Harper has said: "When representative high grade alloys are used, our amalgam failures are always the result of operative faults, generally the result of faulty amalgam manipulation and occasionally due to defects in cavity preparation." I would broaden the last part of the statement to say that perhaps it might be faulty in both respects. The burden and faults now are laid directly on the shoulders of the dentists. It has frequently been said that the manufacturer makes the alloy but the dentist makes the amalgam.

For the manufacturer to make a high-grade alloy is not an easy task. The American Dental Association, through its Research Commission, for the everlasting good of the profession has laid down certain specifications for the manufacturer. These specifications, as research progresses, are revised from time to time. With the Bureau of Standards checking and testing his claims, the manufacturer must be very careful to produce a quality product. Let us see just what we demand in the way of a high-grade alloy. The manufacturer must have consideration for the chemical composition, the method of cutting, the particle size, the annealing and the alloy:mercury ratio to be used in making the mix, so that the final product will be sufficiently soft and plastic to permit easy insertion and adaptation to the cavity walls. Furthermore, it must have the quality of setting soon after being placed; it must not contract or expand appreciably after placing, and it must retain its size and shape permanently. Finally, it must possess sufficient hardness, toughness and strength to resist attrition; it must have good edge

strength, and it must be resistant to the oral fluids of the mouth. All of these properties we demand of an alloy, and we believe that the manufacturer is producing an alloy having the qualities that we demand.

In the analysis and testing processes, we find that practically all of the present-day high-grade amalgam alloys follow the composition specifications of the research commission of the American Dental Association rather closely; that is, they contain a 65 per cent minimum of silver, a 6 per cent maximum of copper, a 25 per cent minimum of tin and a 2 per cent maximum of zinc. They are all well over the required crushing strength of 35,000 pounds per square inch, and all have a very small percentage of flow, which is necessary in order that amalgam be not brittle. It might be said that too large a flow under pressure is perhaps as dangerous, if not more so, than none at all. All amalgams are hard enough to withstand Brinell hardness tests of between 30 and 70. The tensile strength has not been specified. High tensile strength alloys have good edge strength and a tendency toward less brittleness that comes with great hardness. We have the toughness, hardness and strength well taken care of, and we have left to be discussed last the most important property of amalgams: volume change.

Volume change during setting has been a question often in dispute. It has long been known that amalgams expand and contract during the setting period and even after the supposed final setting has taken place. It was from studies of volume change that Dr. Black evolved the balanced alloy. Volume changes have since been studied continuously by different men. Concerning the importance of these setting changes, A. W. Gray says:

> The dimensional changes that occur during the hardening of dental amalgam are of such importance in connection with the tooth-restoring properties of this valuable filling material that determinations of these changes are always made in tests of amalgam alloys. A contracting amalgam may shrink sufficiently to admit oral fluids between filling and cavity walls, whereas an expanding amalgam may swell sufficiently to extend beyond the cavity walls or even split the tooth or cause it to ache. The ideal amalgam expands just enough to make sure that the properly inserted filling will remain firmly in contact with the cavity walls.

Dr. Gray also found that the typical changes are characterized by four consecutive steps: (1) rapid contraction to a minimum, the time consumed in this change being less than an hour in many cases; (2) a somewhat lower expansion to a maximum, usually requiring from one to thirty-six hours; (3) a considerably slower contraction to a second minimum, requiring several months in some cases, and (4) a very much slower expansion to a second maximum.

It was to obtain a more practical knowledge of volume change that, about a year and a half ago, in collaboration with the Southwestern Iowa Study Club, a series of experiments was started. The tests are far from completed, for a study along any line takes a great deal of time, but the results so far have been very gratifying and we have been repaid for the work many times in knowledge gained. It is just such groups of men working together on different problems of the profession that give us a broader concept of what dentistry really is and what it is trying to accomplish. Study clubs should be organized in every locality to investigate all branches of dentistry, for our own knowledge and for the good of the profession at large. Why not try educating ourselves occasionally, along with the constant cry of "Educate the people"? In our group, the main

idea was to check up on a few of the high-grade amalgam alloys for variation in volume change, if any. The work was carried out under varying conditions. The alloy:mercury ratio specified remained the same for each alloy used and, as nearly as possible, the same method of mixing, packing time and packing method was used in each instance.

The Bureau of Standards states that the nearest material to tooth structure in the matter of coefficient of expansion is glass. Glass tubes of various sizes are therefore used in the first set of experiments. About a 1 cm. area on the inside of one end of each tube was ground with a very fine stone to simulate as nearly as possible the cavity wall. The amalgam was mixed and packed according to a standard set up and the tube partly filled with carbofuchsin stain, sealed with wax and allowed to stand at room temperature. It was found that all of the tubes leaked more or less. The same experiment was carried out in an incubator at body temperature and left to stand in the incubator for a week. The tubes leaked. Larger tubes were then used, only one half of the side of each tube being ground, the other being left half glazed, and both tests were carried out. Imagine our surprise and chagrin, when it was discovered that the glazed sides of the tubes did not leak and the ground sides did. Evidently, smooth walls do not have a tendency to leak.

From the glass tubes, we ventured to bonite blocks and teeth, using simple round cavities, rough and smooth; that is, rough to the extent that a cavity is left after preparation with a bur and as smooth as the walls could be polished. After filling, the blocks and teeth were placed in a jar of stain and left for one week. The results were practically identical, the rough walls leaked and the smooth showed no appreciable leakage. From the simple round cavity, we graduated with honors to conventional Class 2 cavities in the blocks and teeth. One set of experiments was carried out at room temperature and another, duplicating the first as nearly as possible, was carried out in the incubator. The cavities for the incubator test were, of course, prepared outside, then placed in the incubator for a time sufficiently long enough to bring them to body temperature before being filled. In the meantime, the stain was also held at body temperature, in jars, into which the specimen was dropped after being filled. The cavities were filled with the incubator door open. It was found that cavities with the conventional amount of retention in the axial portion had a tendency to leak. From the conventional cavity preparation, we ventured to the procedure, proposed before, of locking the amalgam in the cavity in the axial portion, using a 700 fissure bur in the buccal and lingual axiogingival angles, sinking about one half the diameter of the bur into this angle and carrying it about one third the distance to the occlusal aspect, and we were successful.

The last test was carried out in the incubator with different setting times. One group was allowed to set for fifteen minutes before being placed in the stain and another group allowed to set thirty minutes, and the leakage was nil. The conclusions drawn from the work so far done must be that smooth cavity walls and locking the amalgam in are two preclusions to the amalgam alloy restoration leaking. There are still many questions left to be answered in our rather simple but practical experimentations, but we feel sure the answers can be had.

So far, we have considered the amalgam alloy from the manufacturer's standpoint and what can be done along the line of research without elaborate equip-

ment. What part does the operator play in this picture? He is the leading figure, and we are convinced that he can be successful if he only will. From now on, we will consider the conditions over which he has control. If any of the other filling materials were handled as badly as amalgam has been, we would probably have no better results with them, and we would be condemning the gold foil and gold inlay. The operator has the most important steps of all under his control. On the way these steps are taken will depend success or failure. In the past, too much attention has been paid to the brand on the package and too little to the simple successive steps so necessary for desirable results. The best alloy manufactured can be ruined by careless manipulation.

If, then, we are to make amalgam restorations of which we can all be proud, why not start from the foundation, the cavity? You are all so well grounded on Black's cavity preparation that it would be useless to spend any time on it. Suffice it to say that if we but follow in the footsteps of that great preceptor we cannot fail.

There are two steps in the preparation of a cavity that I should like to emphasize. The first is the use of the rubber dam. It is used far too little, and I cannot see how we can hope for the results we desire in any operation, if we continue to regard the use of the dam as we have in the past. The surgeon, when he operates, must have a clean clear field, because he must be able to see what he is doing at all times. Not always does the life of the patient depend on it, but, notwithstanding, his field is clean and clear. In operative dentistry, how can we hope to have a clear field and be able to see what we are doing at all times without the use of the rubber dam? Are we not performing an operation? If the rubber dam is not adjusted, no matter what care is used, how often the cavity is washed out or what it is washed with, there is a film of mucus that cannot be removed and that lies between the fillings and the cavity walls. There is no way to get rid of this mucus, once the cavity is wet with it, except to clean the walls and margins mechanically by instrumentation. No amalgam filling can be made proof against the invasion of bacteria where this film of mucus is present. We must not fail in the first precept of operative dentistry. The paper read before this body last year by Dr. Prime, entitled, "Is Operative Dentistry Failing?" contains much food for thought.[1]

The second step that I would like to call your attention to is the use of the matrix in all cavities not having four surrounding walls. Far too little consideration is given this important step, with a consequent endangering of the tissues surrounding the tooth. No attention is paid to that very important point, contact. The prepared matrix and mechanical holder can be used if the proper care is employed in adjusting. We have found that with a matrix made for each individual condition, the best results are assured and little time is required. This matrix may be of copper or of steel. We have found that the steel matrix, one one-thousandth of an inch thick, ligated and wedged from the lingual portion with a small wooden wedge, so as to bring the gingival portion of the matrix in close contact with the tooth, works best in our hands. Not so much the kind used, but using some kind, is the thing to be considered.

The cavity prepared, the manipulation of the amalgam is the next consideration. Of first importance in the manipulation of the amalgam are a mortar and pestle

1. Prime, J. M.: J.A.D.A., 23:47 (Jan.) 1936.

of proper size and shape. The mortar should have deep straight sides, curved at the bottom, the pestle to fit the bottom and about one quarter of the side. I have ground a glass mortar and pestle in together with No. 200 carborundum powder to insure as close a fit between the two as possible. This will also give the slightly roughened surface so desirable. The use of shallow mortars and poorly fitted pestles prevents thorough mixing. This first simple detail in manipulation has been given practically no attention, and no doubt disregard of it is the first step in the failure of our manipulating procedures.

Of equal importance in securing sufficient plasticity is the alloy:mercury ratio. This ratio is usually expressed as 5:7, 5:8, 7:9, etc. Some, but not all, manufacturers place on the package the proper alloy:mercury ratio for that batch of alloy. It is well to make a mixture or two of each supply of alloy purchased, using the ratio specified to see whether the amount of mercury used will assure sufficient plasticity for your use and for the amount of time it will take you to place the filling. Alloys may be had in two grades, quick and medium setting. Perhaps, for the average operator, the medium set would be preferable, to assure ample time for thorough packing. Perhaps the ratios as given by the manufacturer will not produce enough plasticity for your use. The addition of more mercury will do no harm to the resultant mixture, but the mercury should be added in definite proportions and not haphazardly, as haphazard procedure is apt to breed short cuts and carelessness in other steps of the technic. It is just as easy and takes no more time to follow an orderly procedure throughout the entire technic.

In order that we may not have amalgamation in the completed restoration and contraction and expansion that we cannot control, amalgamation must be as nearly complete as possible in the mortar. Here again, a little experimentation on the part of the operator will be invaluable. With the proper amounts of alloy and mercury added, mixing is started, and only enough pressure should be exerted on the pestle to insure complete amalgamation in from two to three minutes, the time depending on the amounts of alloy and mercury. Heavy pressure may shorten the time of mixing, but then heat is generated, and this may have a deleterious effect on the end-product. The time taken to complete the mixture should be noted accurately. The mixing time varies greatly in the hands of different operators and, for that reason, the time should be accurately noted for each particular alloy or batch of alloy. The resultant mixture should be plastic enough to be spread on the palm of the hand with a very light finger pressure and should have the feel of, one might say, fine velvet. We do not advocate using the palm of the hand and the finger as a mortar and pestle to complete mixing. Most palms are more or less moist and one is sure to rub off some of the first layer of skin. The idea should be to keep the mixture as free from contamination as possible. The plastic mixture will give even the slow operator ample time to make the restoration, and we must have this very plastic mixture in order to obtain adaptation to the cavity walls. The mixture will have a considerable excess of mercury until adaptation is secured, after which the excess mercury can be expressed by an orderly and forcible packing, together with compression.

A word about amalgam instruments: The amalgam instruments chosen should include one rather large one and two or three rather small ones, not to exceed 1

by 2 mm. The instruments should fit the cavity as nearly as possible. We prefer the oblong as this shape enables the operator to reach all angles of the cavity more conveniently.

The amalgam should be inserted in the cavity in an orderly manner. Too many amalgam fillings are removed which give indication that they were pushed in with the thumb, and I have no doubt they were, the thumb not suffering unduly in the procedure. The plastic amalgam should be divided into several small portions so as to be easily picked up with a pair of cotton pliers and placed in position. The first attempts at adaptation should be a sort of tamping to work the amalgam against all cavity walls and to fill in all voids. It will retain its plasticity as it flows to all angles. All that remains now is to compress it forcibly so as to remove the excess mercury and force the amalgam against the cavity walls. Here again, an orderly procedure must be followed, or we will have a weak, leaky, unstable filling with excessive expansion. The pressure, which should be from 10 to 15 pounds, and is indeed a very heavy hand pressure, is started in the center of the cavity and the instrument stepped carefully to the cavity walls and wedged against the walls. The pressure should be maintained momentarily to give the mercury time to flow out of the amalgam. As much as possible, the expressed mercury should be taken out of the cavity before another piece of amalgam is added. The cavity must be filled in its entirety in the same orderly procedure and with the same pressures, or the filling will be weak in spots, with mercury pockets and air pockets. The completed filling will have a considerable amount of mercury on the surface. This can be disposed of by taking the mass of amalgam left after completing the filling, quickly squeezing out all of the mercury possible through a chamois skin and applying this dry mass to the surface of the completed filling, being sure that the margins are well covered and condensing the surface.

The amalgam is now left to harden until it can be carved. The time usually necessary for the ordinary filling to set sufficiently for the average operator will be from ten to fifteen minutes. The matrix, if one has been used, can now be removed, the carving completed and the patient dismissed. Needless to say, amalgam restorations should have the same attention as to polishing and finishing as any other restorations. We believe that better results can be obtained on the average if the filling is left to harden for from twenty-four to forty-eight hours before polishing. We see far too many amalgam fillings that have simply been wiped off with a bit of cotton by way of carving for tooth form, no attempt being made to remove the excess from the gingival margin.

CONCLUSION

Good and serviceable restorations can be made with amalgam.

Only high-grade amalgam alloys should be used. The use of a good alloy does not guarantee a good amalgam restoration.

The rubber dam must be used if an operation is to be performed.

More attention must be given to cavity preparation and accepted scientific procedure must be followed.

The matrix must be used in all cavities not having four surrounding walls.

Ample mercury must be used so that the resultant mixture will have sufficient plasticity, and a definite knowledge of the alloy:mercury ratio must be had.

Amalgamation must be complete in the mortar before the filling is started. The mixing must be timed.

The amalgam is placed in the cavity in small portions and tamped to place to reach all parts of the cavity and then condensed to remove the excess mercury and to wedge the amalgam into contact with the cavity walls by sufficient pressure. The amalgam instrument is stepped in an orderly manner.

The completed filling is carved to correct tooth form and polished.

It is true that to carry out the technic properly will take a little more time and work, but only in so doing will we adhere to professional standards and give to the patient that which he can justly expect.

OPERATIVE PROCEDURES FOR THE DECIDUOUS TEETH*

By GEORGE E. MORGAN, D.D.S., F.A.C.D., Milwaukee, Wis.

SUCCESS or failure in dentistry for children is principally dependent on a working knowledge of the preoperative psychology and a thorough understanding of the operative considerations. The man who thinks that he can be successful with children, either in general practice or as a pedodontist, without considering collectively these principles, is without question destined to fail. On the other hand, if he carefully studies them, preferably when a student, the problems arising in dealing with children will be easily solved. The mountainous peaks then become only molehills as each trying situation is approached.

It is regrettable that a curriculum survey on modern dental education leaves pedodontia entirely out of the curriculum. It makes one wonder whether we have really progressed in this century of dentistry in America. Trying to teach dentistry for children to dental students by giving them a crumb here and there certainly does not indicate progress, as the situation is no different from what it has been for the last hundred years. While the curriculum survey committee is to be commended for its remarks on the need for better and more adequate dental service for the child, it should and will be criticized for not making pedodontia a distinct subject. Pedodontia should no longer be left by the wayside, but should be given its rightful place along with the other branches of dentistry.

Operative procedures must necessarily be preceded by giving some thought to preoperative psychology, which plays such a vital part in the final results.

PREOPERATIVE PSYCHOLOGY

First, to create an atmosphere that provides for relaxation means that the dental office must not be a jumble of artistic array, but rather suggest roominess and simplicity. The child will, in proper surroundings, relax almost instantly and, as a result, be most adaptable to the procedures to follow. Along with simplicity of atmosphere, cleanliness must predominate, as it is one of the best means of establishing confidence. Pleas-

*Read before the Section on Children's Dentistry, Preventive Dentistry and Mouth Hygiene at the Seventy-Second Annual Midwinter Clinic of the Chicago Dental Society, Feb. 20, 1936.

ant surroundings make the child feel welcome and as if he were among friends. If the office is crowded and overly decorated, the child is disconcerted when he steps into the room. He becomes tense and fearful of what may occur—the atmosphere is foreign and his reaction is unfavorable. Loud and shrill voices also tend to have an unfavorable response.

Secondly, we must consider the personality of the child. Is he shy and fearful or precocious, alert and friendly? Children form their likes and dislikes very quickly. Every child is flattered when he realizes that we treat him with the respect shown for an adult. Then, too, any handicapped child resents our consciousness of his being unlike other children. Remember it is "Mary" or "John" and not "Sister" or "Sonny." To the shy, bashful child, let us be sympathetic and kind in our attitude; with the alert and friendly child, firm yet kind. Alert children are sometimes more difficult to manage because of their unusual ability to adjust themselves to new surroundings. They are overly conscious of what is going on. With the physically handicapped child, refuse to notice his disabilities and treat him as normal.

The importance of any service to the child is evaluated by the education we or the parents give to it. A health habit is based on a child's duty toward the betterment of humanity. If he is rewarded for an act in the interest of his health, especially by the dentist, the visit, in the mind of the child, no longer remains in the same category with that of an obligation to himself, but becomes a favor to the dentist. The harm of rewards in dentistry for children is greater than most realize. It not only lessens the child's appreciation of good teeth, but also undermines his confidence, which is necessary for the future of dentistry for children as a health service. The child comes primarily to the dental office for dental services and not for a reward. The logical reward is kindness and good operative care rather than something of intrinsic value. A dentist may be known by the amount of commercial products he hands out to his child patients as rewards.

Thirdly, there is your own personality. The principal means that the child has of drawing his conclusions as to whether we are satisfactory when he first meets us is our appearance. It is most essential that we portray cleanliness in all of its phases: cleanliness of dress, of hands and fingernails and of speech, as well as cleanliness of instruments and equipment. The yardstick that measures our success in pedodontia is our ability and capacity to get along with children. Our attitude toward the child influences the child immeasurably. If the child cannot be managed, it is usually the fault of the dentist, and not the child.

To establish confidence, which is absolutely necessary for success with children, one must be exact in his procedures. It is important to know definitely where we are going before we start. The child will sense indecision very quickly and is almost uncanny in judging our ability by the way we proceed. Likewise, awkwardness in our methods is immediately recognized by the child. This, we probably never realized, was what the child referred to when he said, "That is a new instrument," when, in reality, the instrument was not new. The thought that occurred to the child was "Have you used it before or is the use of it new to you?"

We must also keep up our courage, because, the minute we lose it, the child knows he has the upper hand as far as management of the case is concerned.

Finally, the management of the child may be reduced to the use of what might

be termed practical psychology or good judgment. The daily routine of a child of 3 may include a nap from 1 to 3 in the afternoon. What chance would the best psychologist have in trying to do dental work for this child at 2 in the afternoon? The attempt is sure to result in failure. The best hours for young children are from 9 to 11 in the morning.

Success in dentistry for children is determined by our good judgment in providing a pleasant atmosphere, in selecting an assistant or hygienist, in making appointments, in our attitude toward the child and in our operative procedures. In other words, it is vitally necessary that we use good judgment in everything about us.

OPERATIVE CONSIDERATIONS

Before we attempt actual operative procedures, it is necessary that we have knowledge of the comparative anatomy of the deciduous and permanent teeth. It is only by constantly bearing in mind these anatomic differences that successful cavity preparation can be assured.

The deciduous teeth differ considerably in their anatomic characteristics from the permanent teeth. In comparing, the deciduous molars with the permanent molars, we find:

1. The crowns are more bell-shaped and there is greater constriction at the neck of the tooth. Because of this difference, it is not possible to use the same cavity preparation as for a permanent molar. If the cavity is extended gingivally the same depth in the deciduous tooth as in a permanent one, the horn of the pulp will be exposed.

2. The enamel of the deciduous tooth is much thinner and more brittle and chips easier than that of the permanent tooth. This must all be considered in cavity preparation in the deciduous teeth so that thin enamel walls will not be left unsupported by dentin. When these thin enamel walls chip, the filling is dislodged, and there is a recurrence of decay. Unfortunately, these dislodged fillings do not drop out, but remain loose in the cavity, and decay progresses unchecked until the pulp is involved, soon resulting in the loss of the tooth.

3. The dentin of the deciduous tooth is softer and more easily permeable than that of the permanent. This allows decay to progress more rapidly and discoloration to penetrate very quickly. In cavity preparation, it is absolutely essential that all decay be removed, but many pulps are needlessly exposed because the operator has failed to differentiate between decayed and discolored or stained dentin. If the pulp will be exposed by removal of all the decay, then in reality the pulp is exposed. In other words, if caries has penetrated to the pulp, the pulp is exposed, and leaving a portion of decay in the base of the cavity with the false hope of preventing exposure is wrong.

4. The deciduous pulp chambers are larger in proportion to the size of the tooth than are the permanent and are nearer the outer surface, with perhaps the exception of the occlusal area of the deciduous molar. While the pulp chamber dips considerably in the occlusal area of the deciduous molar, they do have pronouncedly pointed pulpal horns. This makes a vulnerable point for exposure through proximal decay and in cavity preparation, unless extreme care is exercised.

5. The deciduous molar roots are more diverging. Care should be used in extraction to avoid injury to the developing permanent tooth, especially if the molar is lost prematurely, or if abnormal resorption is present, to avoid the possibility of leaving root fragments embedded in the jaw.

A mental picture of tooth formation a:

various ages of childhood helps to determine the procedure. For example, a deciduous tooth that has no permanent successor may require different treatment, or a deciduous tooth with a successor that is inclined to submerge, or a deciduous tooth held firmly in place in the jaw for a child of 10 that has a cavity which requires filling, but in reality, on roentgenographic examination, shows abnormal resorption with extraction indicated.[1] Many times, the roentgen rays take the guesswork out of our procedures in dentistry for the child and are most indispensable in rendering health service to the child.[2]

OPERATIVE PROCEDURES

It is inconsistent to consider operative procedures for the deciduous teeth without devoting some time to a discussion of the mechanical equipment. Few believe or have given any thought to the relation of pain and the revolutions of the engine per minute when the bur is in use. The greater the speed of the engine, the greater the amount of friction, and therefore, the greater the pain.[3] If the belt of the engine is placed on the small pulley and the speed is uniform, the pain from buring is greatly diminished. The use of sharp burs and instruments, as well as a dry field, lessens the pain and discomfort for the child. Less pain is caused if the decay is removed with a large round bur. The size of the bur is determined by the size of the cavity. The indiscriminate use of air to dry the cavity is very painful. A cotton pellet should always be used instead.

The areas in the deciduous teeth most susceptible to decay prior to the eruption of the permanent teeth are the distal surfaces of the first deciduous molars, the mesial surfaces of the second deciduous molars, the occlusal pits of the upper second deciduous molars, the occlusal fissures of the lower second deciduous molars and the proximal surfaces of the upper central and lateral incisors.

To restore these teeth for a child 5 years old so that they will remain healthy until the normal period for their exfoliation is one of the most difficult tasks in dentistry. In a survey of 100 cases, it has been found that 54 per cent of cases of malocclusion are caused by premature loss and prolonged retention of the deciduous teeth, which could be prevented by correct operative procedures.[4]

During cavity preparation, we must constantly bear in mind the anatomic characteristics and the means of conservation of tooth structure. In preparing the cavity in the distal area of the first deciduous molar, whether in an upper or lower tooth, (1) the food débris is removed with a spoon excavator; (2) the overhanging walls are broken down with a chisel, and (3) the decay is then removed with a No. 6 round bur. This is followed by a No. 558 short shank fissure bur, to square the walls of the cavity. Now we are ready for the occlusal step. No proximal cavities that involve the occlusal area should be prepared without the occlusal step.

The occlusal step serves as a means of retention for the filling and should be made by beginning in the occlusal surface with a small inverted cone bur until we have cut through the enamel. Then a No. 558 short shank fissure bur is employed, moving distally. This will be less pain-

1. Kronfeld, Rudolf: Histopathology of Teeth and Surrounding Structures, Philadelphia: Lea & Febiger, 1933, p. 225.

2. Main, L. R.: Roentgenogram, A Guide in Children's Dentistry, J.A.D.A., 22:960 (June) 1935.

3. Bödecker, C. F.: Treatment of Sensitive Teeth, correspondence, D. Cosmos, 70:1133 (Nov.) 1928.

4. Brandhorst, O. W.: Promoting Normal Development by Maintaining Function of Deciduous Teeth, J.A.D.A., 19:1196 (July) 1932.

ful and will also aid in preventing possible exposure of the horn of the pulp. The occlusal step should be broadened to give added strength to the restoration. The outline form should be such that there are no thin enamel walls left unsupported by dentin. If, at this time, a small cavity is found on the mesial surface of the second deciduous molar, it may be filled as a simple proximal cavity,[5] with either silver or copper amalgam.

There are only three filling materials suitable for the distal occlusal cavity in the first deciduous molar. They are a cast gold inlay, a cast silver inlay or silver amalgam. The gold inlay is indicated for very young patients and for those who are able and willing to pay for the best health service for the child. The cast silver inlay makes a good restoration. Silver amalgam is most generally used and, if properly manipulated, will, in the majority of cases, preserve the tooth in a healthy state until the normal period of exfoliation. A matrix should always be used in placing silver amalgam in compound cavities in the deciduous teeth.

It is important that every precaution be exercised in filling a deciduous tooth with silver amalgam. If the filling is placed without a matrix or if a dovetail preparation[6] is made, the tooth cannot remain healthy. Recurrence of decay is sure to follow, and the tooth is lost through careless operative procedure.

In general, the preparation of a mesioclusal cavity in the second deciduous molar is the same as that of the distal cavity in the first deciduous molar. If these two approximating surfaces are in need of restoration at the same time, the cavity in the mesioclusal surface should be filled first. If these teeth are both to be restored with silver amalgam, the filling is placed in the second deciduous molar first and it is polished well at the following sitting before the distoclusal area of the first deciduous molar is restored.

The occlusal pits of the upper second deciduous molars are prepared and filled, if possible individually, without breaking down of the oblique ridge unless it has been undermined by decay. As these cavities are pits and not fissures, little extension for prevention is necessary. Faulty coalescence of the lobes of the lower second deciduous molar results in pits joined by fissures, which usually extend over the entire occlusal surface. These pits and fissures are apparent at different ages in the same tooth.[7] The early recognition of a pit may assure checking of the decay. The restoration of this surface necessitates the cutting away of the fissure, and extension for prevention is essential. In the majority of cases, the restoration will include the entire occlusal surface rather than a pit here and there.

When decay in the anterior deciduous teeth is not extensive, they should be restored with copper amalgam in a simply prepared cavity. These teeth should not be cut wedge shape. If decay is extensive and the angle of the tooth has been lost, and it becomes impossible to get retention without exposing the pulp, the surface may be smoothed with stones and disks and then protected by an application of silver nitrate solution.

As the child grows older, other areas of susceptibility appear. Of these, probably the one most difficult to restore and wherein more restorations result in fail-

5. Morgan, G. E.: Some Every-Day Problems in Children's Dentistry; J.A.D.A. 20:626 (April) 1933.

6. McBride, W. C.: Juvenile Dentistry, Philadelphia: Lea & Febiger, 1932, p. 40.

7. Hyatt, T. P.: Do Pits and Fissures Appear at Different Ages in Same Tooth? D. Cosmos 74:463 (May) 1932.

ure is the distal aspect of the deciduous cuspids. To restore these cavities properly, it is necessary to provide adequate retention by a lingual step preparation. Silver amalgam serves well as a filling material.

After the eruption of the first permanent molar, it is important that the distal surface of the second deciduous molar be watched for caries. If caries occurs, this surface can be restored with the procedure as has been described for a compound filling.

PEDODONTEXESIS

Pedodontexesis may be defined as the scaling, polishing and cleaning of the teeth of children. It is one of the operative procedures that has been much neglected by the profession. The slogan "See your dentist every six months" has caused a misunderstanding among parents. Many mothers feel that they can neglect their children's mouth six months and still not approach the danger line. The frequency of pedodontexesis and examination is dependent on the individual's susceptibility. Many children's mouths may be a complete wreck if six months is allowed between visits. Once each month is not too often for certain children, while others may go as long as three months.

Cleanliness of the mouth is of paramount importance in the prevention of decay, and every child should be impressed with the necessity and instructed regarding home care.

CONCLUSIONS

1. Properly applied psychology increases one's ability to manage children, and instead of pedodontia being a disagreeable ordeal for both child and operator, it becomes a pleasure.

2. A large percentage of cases of malocclusion and dentofacial deformities could be prevented by careful operative procedures.

3. Frequent inspection and pedodontexesis provide a means for early detection of dental disorders and permit correction before the effects have become harmful.

4. Dentistry for children is not a luxury; neither is it an expensive necessity, if care is provided early, regularly and systematically.

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TUBERCULOMA INVOLVING AN UPPER MOLAR TOOTH: REPORT OF CASE*

By EDWARD C. STAFNE, D.D.S., Rochester, Minn.

TUBERCULOMAS are common even in the absence of any evidence of active tuberculosis, and careful postmortem examinations reveal that they are present in an unusually large percentage of cases. Robertson[1] and others have shown that tuberculous infections may remain latent or dormant for indefinite periods. The common locations for such tuberculomas are the

*From the Section on Dental Surgery, The Mayo Clinic.

*Read at the meeting of the International Association for Dental Research, Louisville, Ky., March 14, 1936.

1. Robertson, H. E.: Persistence of Tuberculous Infections, Am. J. Pathol., (Suppl.), 9:711-718, 1933.

lungs, prostate gland and kidneys, and it is not uncommon to find them in bones, particularly the vertebrae. Recently, Hayes[2] reported the finding of one in an edentulous mandible. To my knowledge, the occurrence of a tuberculoma in the maxilla or mandible is rare, and it is this fact that prompts me to report the following case.

REPORT OF CASE

History.—A man, aged 63, came to the Section on Dental Surgery of The Mayo Clinic complaining of pain in an upper left first molar. This pain had been present for about three weeks, and, at first, there had been considerable swelling. On examination, a fistulous opening, from which there was slight drainage, was seen on the buccal mucosa slightly distad from the roots of the first molar. This tooth had been filled several times, and a large filling had become loose and had fallen out a few months before. Prior to the onset of the present trouble, this tooth had not given any trouble.

Examination.—On roentgenographic examination, the pulp chamber and root canals of this first molar were found to be almost completely obliterated by secondary dentin, but there was no evidence of filling of the root canals. (Fig. 1.) Such extensive formation of secondary dentin is not uncommon among elderly persons. The pulp chambers, in this case, were almost obliterated in several of the other teeth. The roentgenogram revealed what appeared to be a radicular cyst involving the roots of this first molar and the entire mesial surface of the root of the second molar. A diagnosis of infected radicular cyst was made from the clinical and roentgenographic evidence, and extraction was advised.

Physical examination, which is a routine procedure prior to dental operations, did not suggest any organic disturbance, and the patient had no other complaints. The systolic blood pressure in millimeters of mercury was 120, the diastolic 72. The specific gravity of the urine was 1.030; the reaction was acid, and there was no albumin nor sugar, but an occasional pus cell. There was a history of pleuropneumonia with adhesions and of a condition thirty years previously that suggested pericarditis. There was no known contact with tuberculosis.

Operation.—The mucoperiosteum was first freed of its attachment to the teeth and then retracted upward. A small opening through the buccal plate was seen at the site of the fistula. This opening had probably been produced a short time before, for there were no adhesions such as are found when the fistulous tract is of long standing. The buccal wall was then removed to allow enucleation of what was thought to be a dental cyst. The second molar came away readily, without the use of much force. When extraction of the first molar was attempted, it was found that the contents of the bony cavity appeared to be firmly adherent to the roots of the tooth. The mass of tissue separated readily from the walls of the bony cavity, and it was removed without disturbing its attachment to the roots of the tooth. Examination of the area that this mass of tissue had occupied revealed a closed bony cavity within the body of the maxilla. The floor of the maxillary sinus had been forced upward, but the sinus had not been penetrated.

Fig. 1.—Periapical radiolucence typical of radicular cyst of root. The lesion proved to be a tuberculoma.

2. Hayes, L. V.: Clinical Diagnosis of Diseases of Mouth, Brooklyn: Dental Items of Interest Publishing Co., Inc., 1935.

Diagnosis.—The presence of tuberculous, infected granulation tissue was diagnosed on microscopic examination of tissue taken from the border of the mass. (Fig. 2.) Sections stained for *Mycobacterium tuberculosis* revealed a few acid-fast bacilli. Microscopic examination of decalcified sections disclosed that the lesion was continuous with the periodontal membrane. (Fig. 3.)

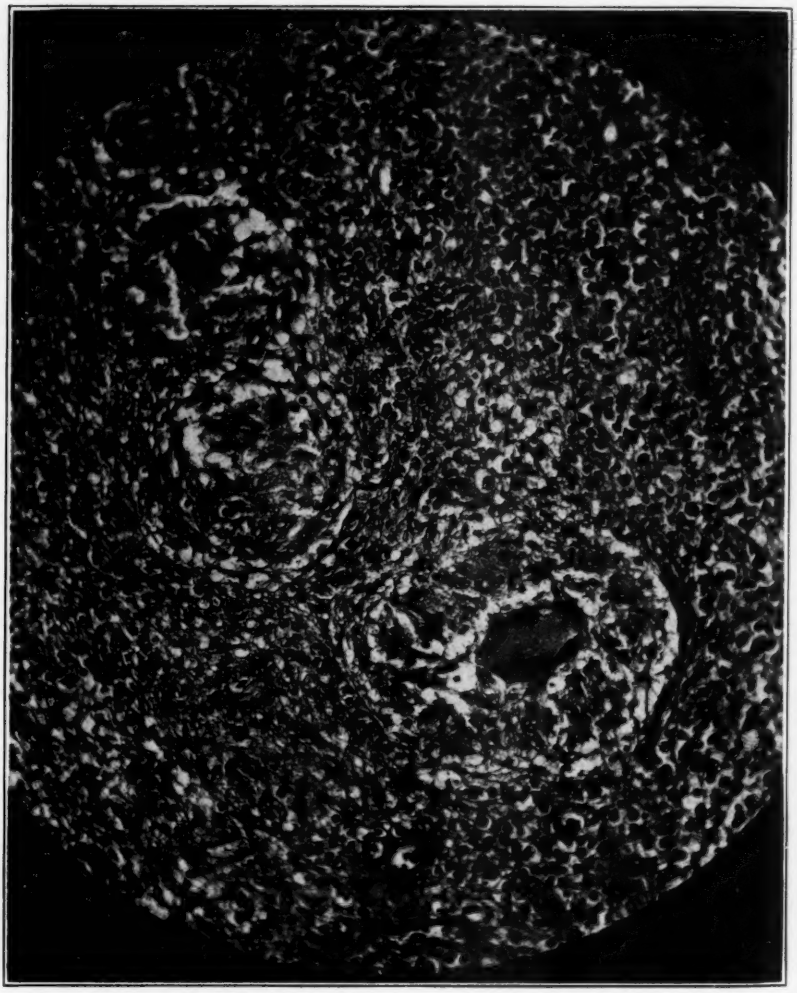

Fig. 2.—Tubercles in tissue attached to roots of first and second molars.

In view of the pathologic findings, the patient was returned to the examining phy-

sician for further investigation. Subsequent roentgenographic examination of the thorax revealed that the patient had once had pleurisy at the right base and tuberculosis of the right apex of the lung. There was no evidence of active tuberculosis. It was thought possible that the lesion of the jaw might have been related to the former tuberculous condition in the right apex of the lung.

Fig. 3.—Decalcified section, showing attachment of tuberculoma to buccal roots of first molar.

COMMENT

Földi[3] has said that oral tuberculous infections (ulcerous or nonulcerous) are exogenous or hematogenous, but never dental in origin. This case raises the question as to whether, in rare instances,

3. Földi, Elik: Tubercular Infection of Teeth (abstr.), J. D. Res., 15:204-205 (June-Aug.) 1935.

tuberculous lesions may not be dental in origin. The lesions had without doubt appeared at a time prior to the onset of the acute periapical infection that brought the patient to the clinic. If it was dental in origin, the most probable port of entry was through deep caries in the first molar, and such entry may have taken place at an early age.

MORPHOLOGY OF ROOT CANALS*

By A. H. MUELLER, D.D.S., M.S., Chicago, Ill.

STUDENTS of anatomy have always known that the central portion of the tooth is hollow, but it was not until about 1870 that any effort was made to set down definite information about the exact formation of root canals and pulp chambers of human teeth. Early writings on this subject were not extensive. Most of the available literature is found in textbooks. Mühlreiter,[1] a German anatomist, published his first edition in 1870, a very small but thorough work.

In the late eighties and early nineties, D. M. Cattell gave many lantern slide lectures on his research work. The dental journals of those years[2] state that Dr. Cattell's lectures expounding his findings were in great demand. It is unfortunate that he never wrote nor published the results of his work. From what older men who heard him and who were associated with him during his research work at the Chicago College of Dental surgery say, Dr. Cattell must have had thousands of sectioned teeth from which he made deductions to carry on his lectures.

In 1890, G. V. Black[3] published the first edition of his "Descriptive Anatomy of Human Teeth." The method used in the study of the anatomy of human teeth by early writers was sectioning, consisting in attaching teeth to wooden blocks and sawing them or grinding them into sections.

Apparently, the first man to digress from this method was Preiswerk, who employed a unique method. After exposing the pulp chambers of extracted teeth and then placing these teeth in water in an incubator for three weeks, Preiswerk would, by chemical and physical means, remove the contents of the pulp chambers and canals. Then, after drying and heating these teeth, he attempted to pour molten Wood's metal into the pulp chambers and canals. The casts were defective because the metal did not reproduce the finer canals and foramina.

About this time, others also felt the need of a method more exacting than sectioning teeth. Guido Fischer,[4] in 1907, reported the results of his attempts, using

*Read before the Section on Therapeutics, Pathology and Research at the Seventy-Second Annual Midwinter Clinic of the Chicago Dental Society, Feb. 18, 1936.

1. Mühlreiter, E.: Anayomie des Menschlichen Gebisses, Leipsic: Arthur Felix, 1870.

2. Dental Review, 1889-1890.

3. Black, G. V.: Descriptive Anatomy of Human Teeth, Ed. 4, Philadelphia: The S. S. White Dental Manufacturing Company, 1902.

4. Fischer, Guido: Über die feinere Anatomie der Wurzelkanäle Menschlicher Zähne, Deutsche Monatschr. f. Zahnheilk., September, 1907.

celluloid instead of metal and preparing teeth in a manner similar to Preiswerk's method. His casts were perfect, but they were not usable because celluloid is very brittle and the finer reproductions are easily broken.

In 1917, Hess,[5] of Switzerland, wrote of still another method. His method of preparing teeth was similar to that used by Preiswerk and Fischer. After Hess had finished preparing the teeth, he forced vulcanite rubber into the pulp chambers and canals and then vulcanized the rubber. The casts were then exposed by decalcifying the teeth. Hess's work seems to give us the best results. He seems also to be the only one who up to this time furnished accurate data on a large number of teeth used, including percentages in each class and type of teeth.

Later, W. Clyde Davis expounded the process of staining the walls of pulp chambers and canals. These teeth can then be transilluminated and studies made of the stained areas.

In 1932,[6] I read a paper on the roentgenographic study of extracted teeth. It is believed that the four processes mentioned: sectioning, casting in vulcanite, staining and roentgenographic study, have given us enough information to gage our diagnostic work on teeth *in situ*.

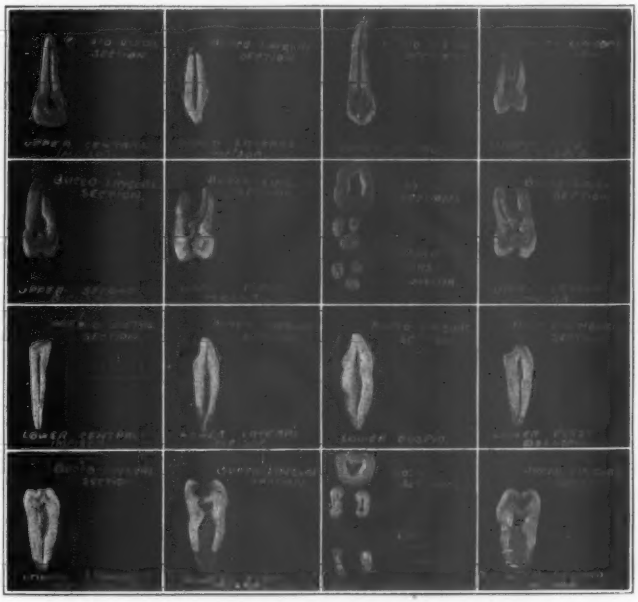

Fig. 1.—Sections made by grinding (longitudinal sections) and sawing (cross-sections). These teeth were sectioned in such positions that the multiple foramina did not show.

5. Hess, Walter: Zur Anatomie der Wurzelkanäle des Menschlichen Gebisses mit Berücksichtigung der feinern Verzweigungen am Foramen apicale, Schweiz. Vierteljahrsschr. f. Zahnheilk., Vol. 27, No. 1, 1917.

6. Mueller, A. H.: Anatomy of Root Canals of Incisors, Cuspids and Bicuspids of Permanent Teeth, J.A.D.A., 20:1301 (Aug.) 1933.

Figure 1 shows sections made by grinding and sawing. The longitudinal sections were ground, while the cross sections were sawed. We know that very few teeth have but one foramen. Still the teeth on this chart (Fig. 1) show no multiple foramina, for the reason that these teeth were sectioned in such positions that the foramina did not show. The early writers were very much in the dark in regard to multiple foramina in the roots of teeth. Whenever they found lateral foramina, they were inclined to consider them as anomalous because they were so infrequent. Not one of the canals in Figure 1 is perfectly straight or conical. The nearest approach to straight and conical canals are those in the central and lateral incisors, and the canals in each of these are decidedly constricted in the apical third. In the cuspid, there is a long curved canal. The first bicuspid has two S-shape canals extending from a possible long pulp chamber. The lingual canal is much longer than the buccal. The upper second bicuspid has a single canal extending from a large and deep pulp chamber. The upper first molar shows two of its three canals. The lingual has a decided curve and is much longer than the buccal canal, which is somewhat indistinct. The second molar presents a picture similar to that of the first molar.

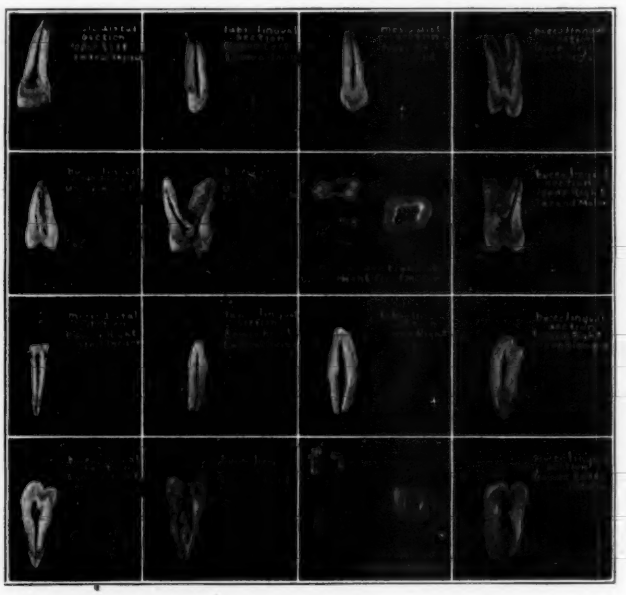

Fig. 2.—Sectioned teeth showing root canals of various shapes.

The lower central and lateral incisors show the usual ribbon-like canals. The lower cuspid shows the usual bulky canal with an irregular taper toward the apex. The first and second bicuspids show small canals. No doubt, these two teeth come from the mouths of older people. The section of the lower first molar must be that of the distal root. The canal is very

wide and appears to be ribbon-like. The section of the lower second molar must be that of the mesial root, for there are two distinct canals, which exit at an angle from the pulp chamber. The lingual canal is quite straight, while the buccal is curved.

In Figure 2 a chart on which sectioned teeth have been attached is shown. The central incisor has a wavy canal, as compared to the straight canal in Figure 1. canal in the apical third. The buccal root of the first molar is very wide. One cannot but conjecture as to what the canal in the lingual root really looks like. The root is very wide and the canal that is exposed is very narrow. The roots and canals of the second molar resemble those of the first molar, except that the roots of the second molar are not spread as far apart as those of the first molar.

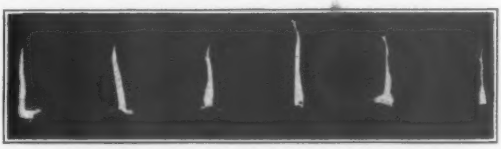

Fig. 3.—Casts of root canals of upper central incisors. (Figures 3-12 are from Hess.)

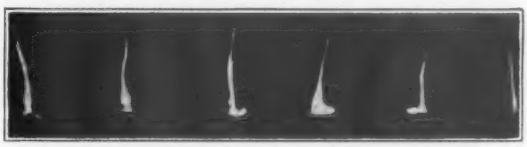

Fig. 4.—Casts of root canals of upper lateral incisors.

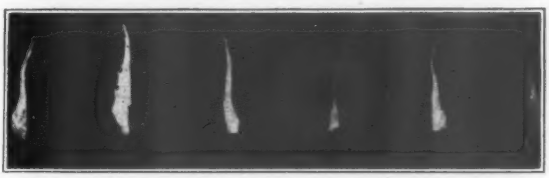

Fig. 5.—Casts of root canals of upper cuspids.

The lateral incisor has a decided turn at the apex, and, in the cuspid, we find an irregular wavy canal. The first bicuspid has a longer buccal root and canal than lingual. Also, the buccal root is curved, while the lingual is quite straight. Both canals emerge from what seems to be a long pulp chamber. The second bicuspid has a large pulp chamber. The canal divides in the middle third of the root and these two canals again join, making one

The lower central and lateral incisors have the usual fine, narrow canals. The lower cuspid shows the usual bulky canal that tapers to a very finely constricted end. The lower first bicuspid shows a large canal, which ends in two very fine canals. The lower second bicuspid shows a fairly straight canal. The lower first molar shows the mesial root with two curved canals that meet at the apex. The lower second molar shows a mesial root

with a wide canal that possibly has divided into two canals, or was in the process of dividing, and which, if it had remained alive, would soon have become two distinct canals.

Figure 3 is the first of a group showing some of Hess's work. Six casts of root canals of upper central incisors are shown. The casts are conical, but decidedly uneven.

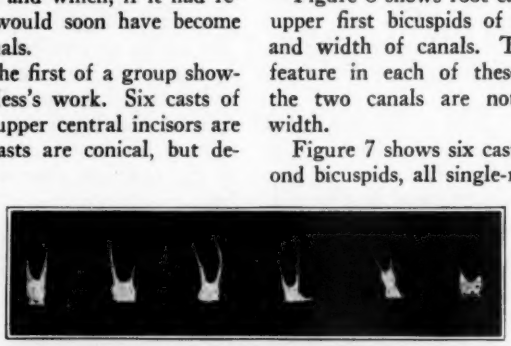

Fig. 6.—Casts of root canals of upper first bicuspids.

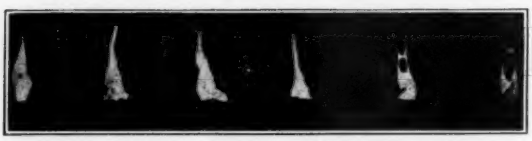

Fig. 7.—Casts of upper second bicuspids.

Fig. 8.—Casts of pulp canals of upper first and second molars.

Fig. 9.—Casts of canals of lower central and lateral incisors.

Figure 4 shows six casts of root canals of upper lateral incisors. These casts are similar to the central incisor casts, except that the root canals of upper lateral incisors are smaller than the root canals of upper central incisors.

Figure 5 shows six casts of root canals of upper cuspids of varying widths, lengths and shapes.

Figure 6 shows root canal casts of six upper first bicuspids of varying length and width of canals. The remarkable feature in each of these casts is that the two canals are not of the same width.

Figure 7 shows six casts of upper second bicuspids, all single-rooted teeth except probably the fifth. Each cast displays an oddly shaped canal.

Figure 8 shows six casts of pulp canals of upper first and second molars. Not knowing which are the first and which are the second molar casts, one might make some wild guesses.

Figure 9 shows six casts of lower central and lateral incisors. Apparently, these are casts of canals of teeth of old people. In the first two and in the sixth casts, there is bridging of the mesial and distal walls of the canals. The third and fourth casts show decided recession of their respective pulps. The fifth cast may be that of a tooth of a person younger than in the case of the five others.

lower first bicuspids in the lower half of this illustration, show rather simple canals, but not one of them is truly conical.

We have considered, from studies of sectioned teeth and from the roentgenograms of teeth *in situ*, that lower second bicuspids have rather simple straight canals. Yet in Figure 11, taken from Hess's illustrations, we find but one of the six casts to be that of a simple straight canal.

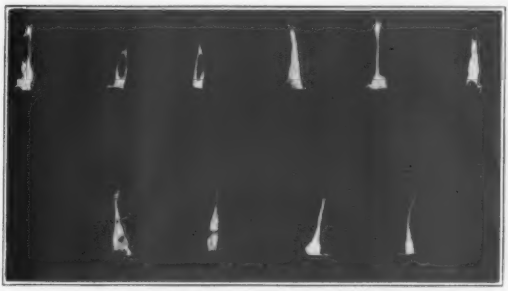

Fig. 10.—Casts of canals of lower cuspids and first bicuspids.

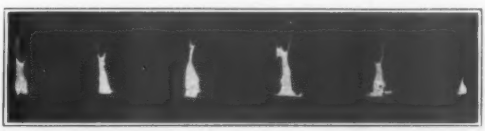

Fig. 11.—Casts of canals of lower second bicuspids.

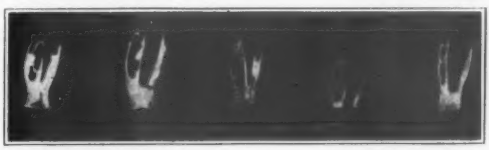

Fig. 12.—Casts of root canals of lower first and second molars.

Hess's[7] casts of lower cuspids invite more thought. In this group of casts, in Figure 10, only one of the six has a single foramen, and it has a divided canal. The rest are very irregular and show many foramina.

Figure 12 shows five casts of root canals of lower first and second molars. They are grotesque looking figures, which represent decidedly irregular canals, irregular as to the fact that they are not conical nor straight.

7. Hess, Walter: Anatomy of Root Canals of Permanent Dentition, trans. revised by William Henry Dolamore, London: John Bale, Sons, & Danielsson, Limited, 1925.

Figure 13 is the first of a group showing roentgenograms of extracted teeth. The upper roentgenogram is a labial or buccal view of the teeth, while the lower is a mesial view of the same teeth. Four upper central incisors are shown. The

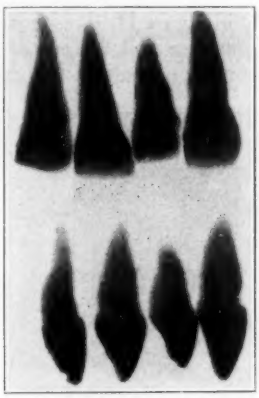

Fig. 13.—Extracted teeth, upper central incisors.

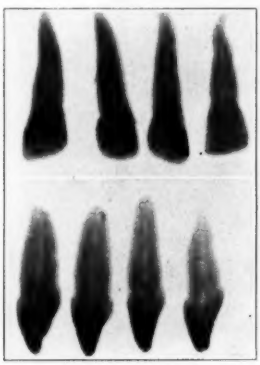

Fig. 14.—Upper lateral incisors.

canals are conical and no lateral foramina are visible.

Figure 14 shows two roentgenograms of four upper lateral incisors. The canal in the fourth tooth is wavy. No lateral foramina are visible.

Figure 15 shows two roentgenograms of four upper cuspids. It also shows an attempt at filling the canals of these cuspids. The mesial view of the second tooth shows a large obstruction in the middle third of the canal.

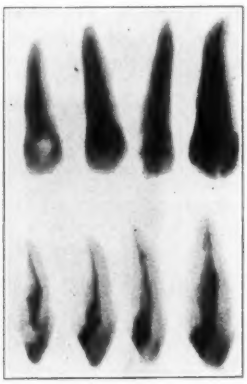

Fig. 15.—Upper cuspids.

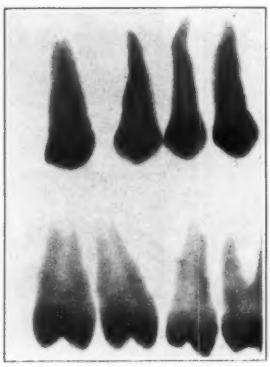

Fig. 16.—Upper first bicuspids with varying types of roots and canals.

Figure 16 shows four upper first bicuspids with varying types of roots and canals.

Figure 17 shows four single-rooted upper second bicuspids. Each canal has

characteristics that vary from those of the other canals of this group.

Figure 18 shows roentgenograms of four lower central and lateral incisors. The root canals in these teeth are typically ribbon-like.

Figure 19 shows roentgenograms of four lower cuspids. The root canals are

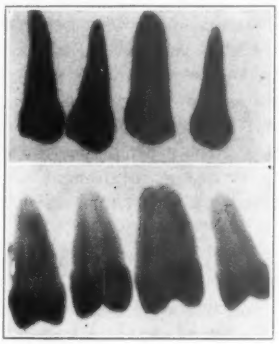

Fig. 17.—Single-rooted upper second bicuspids.

Fig. 18.—Lower central and lateral incisors. The root canals are typically ribbon-like.

shaped exactly like their respective roots. Lateral foramina are not visible in either this or the preceding figure.

Figure 20 shows four lower first bicuspids whose root canals an attempt has been made to fill with eucapercha and guttapercha. The canals are quite typical and no lateral foramina are visible.

Figure 21 shows four lower second bicuspids. The root canals are quite similar to those of the lower first bicuspids in Figure 20.

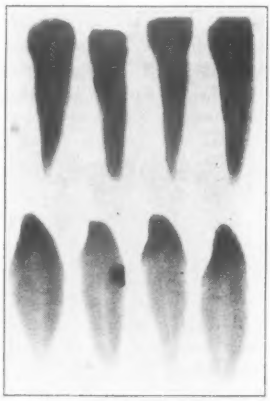

Fig. 19.—Lower cuspids, the root canals of which are shaped exactly like the roots.

Fig. 20.—Lower first bicuspids.

The canals of upper central incisors are of simple form, being conical and almost round. The canals of upper lateral incisors are slightly less round than those of the central, being a little wider labio-

lingually than mesiodistally. The cuspids, both upper and lower, have large conical canals, but are inclined to be, in cross-section, more elliptical. Whenever the upper first bicuspid has two distinct roots, its canals are usually decidedly round and conical. The lower bicuspids have canals that are quite round and conical, but inclined to be ribbon-like in the gingival third of the root. Quite often, the lower first bicuspid has a divided canal in the apical third. Usually, in this type, the canal is very wide buccolingually and then suddenly narrows into a bifurcation making two very small canals. Hess found that, of the lower first bicuspids which he examined, two of them, or 2.3 per cent, had bifurcated canals; whereas, I found seven, or 4.48 per cent.[6] Since then, I have found many more. The upper second bicuspids are next in complexity. The canals of these teeth may be bifurcated at any position and seldom are round. They are more apt, in cross-section, to be in the form of a figure 8. The canals of the lower incisors are usually very wide labiolingually and very narrow mesiodistally. As regards the canals of molars, I believe them to be the most complicated of all. Occasionally, the lingual canals of the upper first and second molars have simple conical canals. Their buccal canals may be conical, but more often they are ribbon-like and have many foramina.

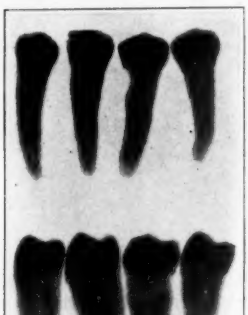

Fig. 21.—Lower second bicuspids, the root canals of which are quite similar to those of the teeth shown in Figure 20.

In closing, I repeat my earlier conclusions[6]:

1. There is not any kind of cone or a measurement of any cone that can be spoken of as being typical of the conical shape of the root canals of any of the human teeth.
2. In each type of human tooth, there are great variations in the shape, length and width of the canals.
3. The canals of one type of the human tooth differ greatly from the canals of another type of the human tooth.
4. Without the microscope, one cannot tell whether a denticle is true or false.
5. A bridge of dentin from one wall of the canal to the other may appear in a roentgenogram as a true denticle.
6. An obstruction in a canal may appear in the roentgenogram to be a denticle, when, in fact, it may be the formation of two canals.
7. The usual labiolingual or buccolingual roentgenogram of the teeth does not always present a true picture of the conditions that are present in the root canals.

EXAMINATION AND DIAGNOSIS PRELIMINARY TO FULL DENTURE CONSTRUCTION*

By R. H. KINGERY, D.D.S., Ann Arbor, Mich.

IN our eager search for methods to improve our denture service, many of us overlook the value of a fundamental that is as old not only as dentistry but also as the entire healing art: Successful treatment depends on thorough examination and correct diagnosis.

The term "value" is used in its true sense, for the technic of examination and diagnosis does not require an expensive outlay of equipment; the only investment is a small amount of time. The results of a careful examination and diagnosis, carefully recorded, are:

1. Information as to the possible difficulties presented in each case at a time when all subsequent steps in construction can be planned with the aim of attempting to overcome these difficulties.

2. An intelligent prognosis based on the knowledge thus gained, a most important phase in satisfactory denture service from the psychologic standpoint. It is far better to give the patient some information regarding the possibilities and limitations of his future restorations before the case is started than to explain fundamental difficulties after the dentures are in service.

3. Correct estimation of the time required for successful treatment, a significant factor in determining whether a case is to be a profit or a loss. Only by knowing the difficulties presented by the individual case can we estimate the time required.

4. An opportunity to make use of our best teacher, experience. We should be able to improve our ability by the experiences we have had in the past, whether they be successes or failures.

In this review, as it is unnecessary to consider all the details involved in an examination, I shall confine my remarks to some of the outstanding factors in the possible outcome of the case. For the sake of convenience, the examination may be divided into two parts: extra-oral and intra-oral.

EXTRA-ORAL EXAMINATION

Age.—It has long been recognized that age is an important factor in diagnosis. There are three stages: youth, maturity and senility, each presenting its individual problem from the standpoint of success in denture treatment. Youth and early maturity, that period up to the age of 35 or 40, might be called the time of body development, in which healing of injured tissues and regeneration in bone structures take place quickly. In this period of life, one adapts himself easily to new conditions. The prospective denture patient in this group will probably cooperate to the extent of adapting himself quickly to wearing dentures. If the patient is healthy and the dentures are well made and are kept adjusted, the foundations under the dentures are usually not subject to excessive change. In treating

*Read before the Section on Full Dentures at the Seventy-Second Annual Clinic of the Chicago Dental Society, Feb. 18, 1936.

this group, the dentist should anticipate the need for some added time and patience when dealing with the esthetic phases of construction. As a rule, these patients are very exacting, for they are at a period in life when appearance means so much.

Owing to the great advances made in dentistry and the increasing reluctance of persons to lose the natural teeth, most patients coming in for full denture service are either in late maturity or the period of senility. These life stages present increasing problems for the prosthodontist. Women in late maturity pass through a nervous disturbance that renders it difficult to gain normal cooperation in denture service, a time when the dentist must be patient, and protect himself with a careful prognosis before treatment is started. Men in late maturity are usually at the height of their business careers; they are busy, impatient, and want maximum efficiency; and here again an outline of the treatment and possible results is of value.

As we encounter increasing age, so must we anticipate possible difficulties. Habits have been formed, and it is difficult to adapt oneself to the compensatory measures necessary in using dentures. The foundation for dentures becomes less adequate as the patient advances into the later stages of life.

Health.—Surely, we are not assuming too much when we state that persons in poor physical condition cannot expect the same efficiency and comfort from full dentures as those in normal health. Like many others, I have, for a long time, observed in the clinic the influence of health on the success of denture service. Recently, we have been given the opportunity to examine and take a history of the patients in the University of Michigan Hospital who are wearing dentures. Even in the short period in which we have been accumulating these records, it is interesting to note that physical disorders and denture difficulties go hand in hand in many instances; and, further, that difficulty in wearing dentures very often develops at the time of physical disturbances. Persons who are suffering from such physical disorders as tuberculosis, diabetes and the various forms of anemia are prone to have easily irritated tissues and foundations that resorb quickly; which makes the problem of maintaining stability and occlusion difficult, if not impossible. The physical condition of the patient coming in for denture service is a vital factor in diagnosis and prognosis. In making a prognosis, it is always well to mention that fatigue or nervousness increases consciousness of dentures. At the end of a tiresome day, any discomfort is magnified, and it is well to warn the patient of this fact.

Mental Attitude.—I have said that diagnosis furnishes information as to possible procedure in treatment of the case; likewise, diagnosis of the mental attitude determines the psychologic treatment of the case. Prognosis is influenced by the type of person that we are treating. For our own protection, it is necessary to explain the possibilities and limitations of the artificial denture before it is started. The only information that laymen have regarding artificial dentures is based on the experience of a friend or relative; hence, they come to us usually with one of two mental attitudes: overconfidence or, the other extreme, lack of confidence. Surely, the prognosis would be entirely different for these two types. The dentist who allows the overconfident person (or one who thinks dentures will be better than his own teeth) to receive his dentures without information as to the possibilities of the case is inviting difficulties.

The exacting person quite often has had previous experience, and a keen

analysis of the former denture deficiencies, as well as a general diagnosis, is of prime importance.

Most writers have given us another classification known as the "passive mental attitude." The patient usually is entirely satisfied with his present condition of masticatory function, whether he is edentulous or whether he has an old, ill-fitting set of dentures; but, for esthetic reasons, some member of his family has persuaded him to come in for new dentures. Careful examination and diagnosis are important, for these cases often prove troublesome. It is well to outline the cooperation necessary on the part of the patient for adjustment to the changes that must be made to secure the desired esthetic results; for we should always remember that, in the layman's eyes, the dentist is responsible for the outcome of the denture service, regardless of the patient.

Lips.—In the examination of the lips, there are three conditions that have an influence on the treatment of the case: (1) extreme shortness of the lips affects tooth position and size and exposure of tooth surface in conversation; (2) activity of the lips or peculiar lip habits have a similar influence; (3) tenseness of the lip is important not only from the standpoint of esthetics, as stated above, but, if present in the lower lip, may, for a time, cause dislodgment of the lower denture on opening the mouth. This last condition demands care in lower anterior tooth position and in length and contour of the labial flange, and an explanation to the patient that will aid in securing his cooperation until such a time as the musculature of the lower lip will have adapted itself to the new support.

INTRA-ORAL EXAMINATION

Preextraction Examination.—It is becoming more and more common for the patient to see the dentist who is to construct the dentures before removal of the teeth. This practice is helpful in many ways and certainly should be encouraged. Without becoming involved in either the problem of oral surgery or partial denture construction, let us consider from the point of view of full denture service the diagnostic factors presented before the teeth are extracted.

1. Certain patients would enjoy more success with full dentures if they could have experience with a retained appliance first. In other words, if an examination reveals possible full denture difficulties, such as abnormal ridge conditions, unstable temperament and poor physical conditions, it may be advisable to retain certain teeth for a time to aid in stabilizing a temporary or treatment partial denture.

2. The occlusal surfaces of the remaining teeth give us information regarding the type of function to which they have been subjected. The presence of flattened cusps designates a wide range of lateral movement, and marked abrasion of the occlusal surfaces indicates strength of the biting force, which is always to be considered in tissue-borne appliances.

3. The position of the remaining teeth indicates clearly the masticatory habits. If the anterior teeth remain for a period of time, the patient becomes a nibbler, and he should be warned against the continuance of such a habit with artificial dentures.

Tissue Conditions.—Four types of tissue conditions are encountered in edentulous mouths:

1. The normal tissue, usually pinkish and slightly yielding, is the most common. If everything else is normal, this tissue serves very well in its support of dentures, and the case presents no particular difficulties.

2. The second type might be called an anemic tissue for want of a better term. This refers to the picture presented by the tissue rather than to a physical condition. The tissue usually has a blanched appearance. It is nonyielding and seems to be thin and almost stretched over the process. This type of tissue is frequently found in persons who are below normal in health. The prognosis is for sensitivity and irritation of the oral tissues on the slightest provocation. In many of these cases, it is most difficult to secure retention. We should also expect foundation changes, and these persons are often in the class of those constantly coming in with loose dentures.

3. The third, or hyperemic type of tissue, is frequently called "rubber-sore" tissue. Undoubtedly, there are some persons who cannot tolerate rubber; but I believe that the above-mentioned condition is most frequently caused by ill-fitting or poorly occluded dentures. In this condition, diagnosis is very important from the standpoint of treatment. The new restorations must first be planned to prevent, if possible, the recurrence of the condition. Secondly, some effort should be made to reduce the inflammation before impressions are taken, as, otherwise, there is every possibility that the new dentures will lose adaptation in a short time as the tissues become more normal. Preliminary treatment in these cases requires the removal of the cause or a rest period without dentures before the wearing of the new dentures is attempted.

4. Hyperplastic tissue has been well described macroscopically as well as microscopically by Drs. Pendleton and Glupker: "Areas of hyperplastic tissue indicate resorption of bone and are found in regions diametrically and diagonally opposite to the areas subjected to 'positive force.'" This type of tissue is most commonly found in patients who have worn an upper denture against the lower anterior teeth for a period of time. The area from cuspid to cuspid is usually a flabby, pendulous mass, as are the tuberosities frequently in these cases. The examination to determine the extent of bone destruction is very important. Cases showing much bone destruction require surgical treatment as well as new dentures to correct the cause of the hyperplasia. If I may digress slightly, we have found that if a v-shaped notch of tissue is removed from the crest of these areas and the loose ends are sutured, these areas become quite stable owing to the density of the scar tissue formed, and denture construction is far easier than if this tissue is removed completely.

Osseous Structure.—The roentgenogram is just as great an aid in the examination and diagnosis of an edentulous case as it is in any other type of dental treatment. It enables us to study the structure of the bone, which is a possible prognostic factor in the future service necessary to maintain function and comfort in the restoration. While the technic used may influence the picture presented, lack of proper regeneration of bone in tooth sockets or lack of density in the bone itself leads one to anticipate possible foundation changes. It also enables us to note unevenness of the surface of the bone structure, such as is caused by the presence of sharp spicules, a very common cause of denture discomfort; and to study pathologic areas in the bone as well as the not infrequent presence of a root tip.

Arches and Ridges.—In a consideration of the arches and ridges, may I mention a few factors of significance in the prognosis and treatment of the future case. The first is that of undercuts, particularly in the region of the maxillary tuberosity. The frequent occurrence of undercuts in this region is very often due-

I believe, to the fact that the first or second molar has been lost early in life and the remaining posterior tooth stands alone or serves as an abutment for a bridge. There is some resorption of the process anteriorly and posteriorly, but, owing to the added stress that the individual tooth withstands, there may be an actual thickening of the buccal plate around this tooth. If, at the time of removal, this tooth is merely extracted with no thought of trimming the buccal plate, invariably an undercut or ledge will be the result. Bilateral undercuts in the region of the tuberosities, unless removed, are a hindrance to retention. A unilateral undercut can sometimes be used as an aid to retention. If the denture can be inserted over the undercut first, the diagnostic factor in this last instance is the anterior ridge. If there is a decided shelving in this region, the denture can be inserted in only one way and the posterior undercut must be removed.

The second factor which is significant to diagnosis, when present, is that condition known as torus palatinus, or the presence of a bony eminence over the midline in the vault of the mouth. This is not uncommon and, in the examination in such a condition, there are two points to consider: 1. The thickness of the area or the amount it projects downward from the vault. If it is thick and large, there is a tendency for the patient to complain of a full feeling or lack of tongue space owing to the amount of relief necessary over such an area. 2. The posterior limits of the bony area. Occasionally, this excessive bony development extends to the distal borders of the hard palate, involving the posterior border of the denture. These areas present a problem in retention and necessitate either surgical interference or an alteration in the design of the palatal portion of the denture. A similar bony development is sometimes encountered in the mandible, usually in the bicuspid region, and is spoken of as torus mandibularis. Owing to the thin covering of tissue over such areas, any movement of the lower denture causes irritation. Some form of relief is indicated, and, in extreme cases, surgical measures are necessary.

The third factor is the examination of the region of the mylohyoid ridge. Very often, especially if much resorption has occurred, the ridge becomes sharp and is a common area for irritation when a lower denture is worn. Surgical procedure is questionable in this area owing to the thinness of the tissue and the lack of blood supply. Relief of the denture over this area is indicated.

The fourth factor that might be considered in the examination of ridges is the amount of resorption that has taken place. In the maxillary ridges, resorption changes are greatest on the crest and buccal surfaces; hence, we not only have the height diminished, but also the crest of the ridge is moved toward the lingual aspect. On the mandibular ridge, resorption reduces the vertical height and, owing to the angle of the body of the mandible, causes the crest of the lower ridge to move buccally. Consequently, with the various stages of resorption, we have an increasing variation in the interalveolar crest angle, which requires a careful arrangement of the teeth to prevent crowding of the tongue and dislodging of the dentures.

Throat Form.—Every paper on diagnosis should include a consideration of throat form. The number of patients brought to the clinic with trouble in retention of the upper denture leads one to believe that many overlook this important point. Prognosis or information given to patients presenting difficult throat form is of the utmost importance in securing their cooperation. The diag-

nostic factor in throat form is the angle formed by the soft and hard palates. The closer the soft palate comes to forming a right angle with the hard palate, the less postdamming area there is, and the problem of retention of the upper denture is correspondingly difficult.

Tongue.—No examination would be complete without noting the size of the tongue and securing a history of the previous dentition. To be more explicit, we all know that the shape of the tongue is governed by the teeth in the arch. A patient who has been edentulous as regards the posterior part of the mouth for a long period of time invariably has a tongue that has become broader in this area. In these cases, explaining a possible temporary sensation of crowding of the tongue or a tendency to raise the lower denture is a very wise procedure.

EXAMINATION AND DIAGNOSIS IN DENTURE CASES

Examination and diagnosis in denture cases must consider, in addition to the foregoing facts, the reason for the failure of the dentures that the patient is wearing. There are a few persons who, owing either to some physical condition or to a neurotic makeup, might be said to have a denture complex. This type of patient very often proves troublesome, and only by careful examination can we determine whether we can better the case and how such improvement can be accomplished.

There is a prognostic factor of importance in the case of patients already wearing dentures. Very often, much ridge destruction has taken place, with accompanying facial deformity and a loss of vertical dimension. These patients greatly anticipate an improvement in facial expression. Granted that great esthetic improvement can be made, in some of these cases the mechanical problem limits the extent to which we can go if the denture is to be comfortable and efficient. This fact should be discussed thoroughly with the patient, and the future possibilities and limitations should be thoroughly understood by him.

Aside from the two problems mentioned above, the neurotic and the esthetic, the examination of a patient wearing dentures becomes one, as I have said, of determining the cause of the difficulties arising from the ones that he is wearing. The possible causes of failure constitute a paper in themselves. A brief discussion of the most common causes might be in order. Looseness of the dentures usually results from one of several conditions:

1. Poor adaptation. This may be determined by the usual methods of testing for retention.

2. Interference of occlusion. This may be determined by observation of the denture during mandibular movements. The two factors are (1) lack of mechanical balance, which causes tipping, and (2) lack of freedom in movement, sometimes spoken of as locked centric occlusion.

3. Error in centric relation or uneven occlusal contact in this position. This may be determined by observing closure in centric relation and by checking the occlusal contact with wax.

4. Loss of vertical dimension. Whenever the vertical dimension changes from that which was established at the time of the original construction of the case, there is an accompanying change in centric relation. The diagnostic factors in dentures showing an error in centric relation should always include a possible change in vertical dimension.

5. Overextension. This may be a cause of dislodgment, which is easily determined by testing the border tissue in contact with the denture or by the manifestation of irritation in this area. In case of irritation, particularly on the lingual

flanges of the lower denture, one should eliminate the possibility of occlusal interference before removal of an excessive amount from the periphery of the denture.

6. Too high an occlusal plane or too great lingual inclination of the lower posterior teeth. This possibility should always be considered in determining possible looseness in lower dentures.

One could continue at length regarding diagnostic factors in denture deficiencies. May I emphasize the point that the possibility of correcting a deficiency is far greater when one understands the cause.

THE EYES OF THE DENTIST AND OF HIS PATIENTS*

By SANFORD R. GIFFORD, M.D., Chicago, Ill.

MEMBERS of the dental profession, like the ophthalmologists, have, during the past twenty years, been passing through a period of rapid change. Not long ago, the dentist was considered an expert workman on the teeth and an executioner of them when repair was no longer possible; just as the ophthalmologist was a fitter of glasses, or an extractor of cataracts, both working in important, but relatively isolated, fields. Rapidly, we have learned that these fields are by no means isolated. It is now a truism to state that both eyes and teeth are only parts of the body, to be studied and cared for in relation to the body as a whole. We are both increasingly dependent on consultation with our colleagues in other branches of medicine and are more and more often called on by them for help. In ophthalmology, for instance, we are able to study the retinal vessels and optic nerves directly with the ophthalmoscope, and such findings are part of any complete examination in vascular and neurologic conditions. There are very few eye conditions that are not dependent on disturbances elsewhere in the body. Even refractive errors, though usually born with us, are sometimes brought on by diabetes, senility or hyperthyroidism.

It will be well to review the most important ocular conditions in which dental disease is a factor. Most of these conditions of the eye, as of other organs, are due to infection. A smaller group, and one in which the influence of dental disease has less often been proved, is that in which reflex irritation has been invoked as the cause. This may be dismissed with a few words. Certain cases of pain referred to the region of one eye may be due to pressure on the nerves from an impacted molar or root abscess. Hyperemia of the conjunctiva, excessive lacrymation and sensitiveness to light may have such a cause. These conditions in such a form as to demand the services of an ophthalmologist are not common, but they do occur, and when the ocular symptoms are not explained by local conditions, examination of the teeth, as well as the neighboring accessory sinuses, will sometimes reveal the cause.

Of the much more important group of

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diseases due to infection, the most common and most important is uveitis. This is an inflammation of the uveal tract, the middle or vascular coat of the eye, including the iris, ciliary body and choroid. When the iris is chiefly involved, we have iritis, and when the ciliary body is included, as is usually the case, iridocyclitis. The acute form of iritis is ushered in by redness of the eye and severe pain. The usually clear fluid in the anterior chamber becomes cloudy and rich in fibrin; which causes the iris to adhere to the crystalline lens. At first, such adhesions may be broken up by drugs that dilate the pupil, but they rapidly become more firm so that this is no longer possible. In a mild case, the attack may subside under local treatment, but subsequent attacks occur, and during each attack, more adhesions develop, until the pupil is completely bound down and occupied by a membrane, which, according to its density, more or less completely interferes with vision. In other cases, the first attack is a severe one and rapidly goes on to this stage. If the condition is now relieved by therapeutic measures, the eye becomes quiet, and some degree of vision may be later restored by operation.

In acute iridocyclitis, the initial symptoms are the same, but exudate is formed farther posteriorly, and contraction may result in retinal detachment or shrinkage of the whole eye. All the sight in this case is lost, and removal of the eye may be later necessary on account of severe pain. I once was obliged to remove both eyes, already hopelessly blind, in such a case, because of the intolerable pain.

In the chronic forms of iritis and iridocyclitis, there is less pain and congestion. In fact, there may be almost none. A process similar to that just described goes on, in very gradual stages, so that it requires years for the same amount of damage to be done as occurs in a few weeks of the acute disease. Various complications are more common in the chronic form, one of the most important being secondary glaucoma, in which fluid collects behind the iris and causes the eye to become abnormally hard. This causes rapid and permanent loss of vision by pressure on the optic nerve and is amenable to treatment only before such damage has occurred.

When the posterior part of the uveal tract is affected chiefly, the condition is a choroiditis. This differs from iridocyclitis by the usual absence of pain and redness of the eye. The only symptom, as a rule, is loss of or cloudy vision. Areas of infiltration form in the choroid and their pressure involves the overlying retina. The vitreous body, a clear jelly filling the posterior chamber, becomes filled with cells and partially fluid. Greater or less loss of vision occurs according to the size and location of the area involved. Choroiditis, like iritis, may be either acute or chronic, but the acute form of choroiditis is less often seen in an early stage because of the absence of pain.

In this group of conditions involving the uveal tract, we must believe that infection is the cause in practically every case. In a small group of cases occurring in gout and diabetes, toxins of another origin are presumably the cause. But in probably 90 per cent of cases, some form of infection is at fault. This has been known for only a relatively short time. In some modern textbooks, there are still to be found discussions of "rheumatic iritis," in which the occurrence of iritis and rheumatism in the same person is noted, without any conclusions as to the cause of either. But most of us now know that a common source of infection for both diseases is present, if it can be found.

The etiologic diagnosis is now our most important consideration in a case of uveitis. Until Koch's discovery of tuberculin in 1890, the development of the Wassermann test in 1906 and the work of Billings and Rosenow on focal infection in 1909-1916, such a diagnosis was in most cases a doubtful matter. Important also was the development of the roentgenologic technic, as you all know so well.

Syphilis was thought to be responsible in from 17 to 22 per cent; gonorrhea, in from 3 to 6 per cent; tuberculosis, in from 2.6 to 45.6 per cent, and focal infection, in about 40 per cent of cases. This last figure is the average for series of cases in this country, where the importance of focal infection was first recognized. In the series of Brown and Irons, the figure was 42 per cent; while in my series, it was 41.5 per cent. The figures are quite different in most European series, in one of which 45.6 per cent of cases were thought to be due to tuberculosis, and focal infection is hardly mentioned. In some places, such as the Elschnig clinic in Prague and certain of the Italian clinics, focal infection is being recognized, but it is remarkable how many otherwise excellent clinicians have failed to realize its significance.

In more detail, my own series showed 16.9 per cent of cases to be due to syphilis; 8.5 per cent, to tuberculosis; 5.1 per cent, to prostatitis, chiefly gonococcal; 1 per cent, to pelvic infection; 6.8 per cent, to sinusitis; 1.7 per cent to other rarer foci of infection; 22 per cent, to infection of the tonsils, and 12.7 per cent, to dental infection. In 8.5 per cent, several causes were found, while, in 32.6 per cent, I was obliged to write "cause undetermined." Figures for dental infection as a cause of acute iritis range from 1.2 per cent (Gilbert) to 32 per cent (Bulson). In three American series, including my own, the average was 13.5 per cent. The figures from the Elschnig clinic are interesting: In 1912, the figure for dental infection was 0; while, in 1925, it was 20 per cent. As would be expected, dental infection is more often responsible for iritis in persons past middle age; while, in children and young adults, the tonsils are the most common source of focal infection. It is remarkable that certain persons still reach adult life with the tonsils intact, and we are always being reminded that so-called tonsillectomy does not always remove the tonsils, stumps being left to serve as foci of infection. This is sometimes the case with teeth. Benedict and Woodson called attention to the necessity of roentgenographic examination in persons who were apparently toothless, and cited cases in which retained root fragments were serving as the important focus of infection. I have had a few similar experiences.

In chronic uveitis, the incidence of tuberculosis as a cause is undoubtedly higher than in the acute form; but focal infections are still important, and the relative importance of the teeth is about the same as in the acute form.

There seems to be no doubt that the organisms or their toxins reach the eye from a focus of infection through the blood stream. There is still a tendency to look for dental infection on the side of the affected eye, a relic of the time when the lymphatic route was thought to be the one commonly followed. Bad roots on the opposite side are as commonly responsible, and, of course, their products may reach one eye as readily as the other when once in the general circulation.

The theory of Rosenow requires that streptococci themselves shall reach the affected tissues, and the experimental work by Rosenow, Haden and others

seemed to favor this theory. It seems that this is really what happens in most cases, and the numerous negative cultures obtained from the aqueous fluid during acute iritis need not be considered as proving the absence of organisms in the tissue of the iris and ciliary body. Traut recently obtained blood cultures of streptococci in patients during acute attacks of iritis, identical organisms being cultured from the foci, usually infected teeth. While few others have obtained such results, it does seem likely that patients harboring foci of infection have "showers" of organisms into the blood stream, from which they reach the eyes and other organs.

The clinical evidence of the importance of focal infection includes freedom from recurrences after removal of suspected foci. Brown and Irons reported fifty cases followed from three to twelve years. Twenty-three patients had been subject to repeated attacks before removal of foci. Of the fifty cases, forty-three remained free from any later recurrence. Such results are somewhat better than most of us are able to obtain, for reasons that will be explained.

I have spoken at some length on uveitis because it is by far the most common condition in which we require the help of our dental confrères. A few less common conditions may be mentioned briefly. Scleritis or episcleritis, an inflammation of the outer coats of the eye, is very commonly due to focal infection. It is less serious than iritis, but very prone to recurrence until the cause is found and eliminated. Optic neuritis, or inflammation of the optic nerve, is more often due to syphilis or to inflammation of the neighboring sinuses; but cases do occur in which infection of the teeth seems to be the cause. As this is an exceedingly serious condition, in which most or all of the vision may be lost within a few days, it may be necessary to advise the removal of definitely infected dental roots without being sure that the infection is the cause. Keratitis profunda, or inflammation of the deeper layers of the cornea, is in a like position, though here one need not decide so rapidly on radical measures. In all of these conditions, as well as in uveitis, we are obliged to search for a cause and, when it is found, to insist on its removal, if this is possible.

An entirely different set of circumstances is presented by the patient with senile cataract who is being prepared for operation. Here, we know that no focal infection is causing the condition, but we have learned by experience that the presence of infected dental roots or other foci of infection may interfere with a good result by causing postoperative uveitis. Hence, dental roentgenograms are part of the routine physical examination of such patients, and when infected roots are discovered, it seems safest to advise their removal several weeks before the operation is undertaken.

In return for the cooperation of the dentist in cases of the type described, it is certainly to be expected that the ophthalmologist, like any member of the medical profession, will use judgment in respect to such important organs as the teeth. In the first flush of enthusiasm about focal infection, thousands of teeth were sacrificed unnecessarily in patients with various conditions having nothing to do with focal infection. Unfortunately, some are still being so sacrificed, but I am sure that the number of ophthalmologists who advise removal of teeth for chronic simple glaucoma, optic atrophy, cataract, retinal detachment and choked disk is steadily becoming smaller. It is true that certain cases of glaucoma, and even of cataract of the type called cataracta complicata, are the result of uveitis and must be treated as such. But,

in their typical forms, these conditions have nothing to do with focal infection and should not require the sacrifice of important organs except in preparation for operation.

In the case of pulpless teeth with no evidence of apical infection, we are often in a quandary, and from what I learn from excellent dental authorities, there is a difference of opinion among your own ranks as to whether we shall regard such teeth as foci of infection. The tendency, I think, is to spare them until there is roentgenologic evidence of infection, a tendency that we must respect. But, in certain serious conditions, undoubtedly due to an infection, with danger of rapid loss of vision, we must sometimes advise removal of every possible source of infection, including such pulpless teeth. We are sometimes surprised to find small granulomas that were invisible in the roentgenograms and to obtain relief from a serious condition upon their removal.

In many ocular diseases, time is a most important item, and we may often seem to show indecent haste in advising extractions. By frank discussion in individual cases, the good ophthalmologist should be able to convince the good dentist that he has not only good intentions, but also enough clinical judgment to make his intentions worth considering.

I would like to spend a few minutes on the subject of the dentist's own eyes; for there is surely no group of men, unless it be the watchmakers, who so abuse their eyes as do the members of the dental profession. Fortunately, the eyes are made to stand a tremendous amount of abuse, and it may set some of your minds at rest to know that few ocular diseases are really caused by close and fine work, even when continued throughout a lifetime.

I am well aware that this is contrary to widespread popular opinion, but, in general, it is none the less true. A few rare exceptions may be thought of. There are ophthalmologists who still warn myopic patients against the dangers of close work. I am supported by what I consider the best ophthalmologic opinion in believing that increase of myopia due to close work has not been proved, and that this theory will not stand the light of impartial investigation. In all probability, certain of us are doomed by our heredity to become myopic to a certain extent and no more, whether we are coal heavers or dentists. Certainly, the other refractive errors are not influenced in any way by close work.

While the structures of the eye itself will stand close work remarkably well, what will not stand it is the nervous endurance of certain persons who are forced to persist in close work under unfavorable conditions. To do such work, the vision must not only be perfect, but the muscles of accommodation must be capable of constantly repeated rapid and accurate adjustments. These adjustments must be coordinated with the muscles of convergence, which are also subjected to constant strain. Most of us are capable of such coordination without conscious effort, provided vision is good. Others are unable to carry them out without symptoms of fatigue, headache and a degree of nervous exhaustion that makes good work impossible. These are the symptoms of eye strain, and while they in no way endanger the vision, they form an important obstacle to the success and happiness of many men, especially in your profession.

There are many things that may be done to lessen the load of such difficulties, and it is only a few who are obliged to give up the professions of medicine or dentistry because of them. First of all, persons with important ocular defects,

irremediable by glasses, should not be encouraged to study dentistry. If vision cannot be brought up to 20/30 with glasses, remedial measures will seldom allow such a person to engage safely in the practice of dentistry. In most cases of refractive error, vision can be brought to normal or nearly normal by the use of glasses. The choice of such glasses requires the services of an expert, and this means a physician trained in examination of the eyes. Examination must be made in persons under the age of 45 both with "drops" and without them, so that the condition of the eyes when the muscles are completely at rest and when working under ordinary conditions may be known. A part of this examination should be an investigation of the ocular muscles and their balanced action. Slight degrees of muscular imbalance that would never be noticed by a coal heaver will often cause severe symptoms in a dentist. While most of us do not acquire "old sight" requiring separate reading glasses or bifocals till the age of 43 to 46, the constant close work of dentistry often requires an additional correction for this near work at the age of 35 or even earlier, and such correction should be given in many cases.

When we give additional reading correction to an early presbyope, we lessen the amount of effort required of his muscles of accommodation for near work. But this lessens the amount of convergence that automatically follows accommodation, and this may produce an imbalance that makes near work exceedingly uncomfortable. It is possible to overcome this imbalance by adding prisms to the correction for near work, and these are more often necessary in dentists than in members of most other professions. There are methods of strengthening these muscles by exercise, and such exercises will often permit the patient later to dispense with the aid of prisms for reading. All of these facts must receive special consideration and must be weighed together before a final correction is chosen. It may be necessary to try this combination or that before one is found that permits close work with a minimum of discomfort.

Binocular vision is especially important to the dentist, who must work with the utmost accuracy in small spaces. Hence, a man with one defective eye or with a difference of refraction between the two eyes so great that proper correction cannot be made with comfort is at a special disadvantage. A case of the latter kind is that of the man who has had a cataract of the traumatic or presenile variety in one eye. It has been removed, leaving him with an excellent eye, but only when aided by a strong lens. This creates a disparity in the size of retinal images, which makes binocular vision impossible with ordinary lenses. To meet this situation, a method has recently been devised of making lenses that equalize the retinal images. I have two patients in the dental profession who are wearing such lenses now and who have excellent binocular vision, though each has had a cataract removed.

The bodily health is, of course, exceedingly important in maintaining the neuromuscular arrangements of the eyes at their maximal efficiency. One often sees marked insufficiency of the ocular muscles in persons who are nearing the end of a typical Chicago winter, overworked, underexercised and underaerated. After a vacation, conditions may change markedly, and all symptoms of eye strain will disappear. A proper amount of exercise and proper diet are essentials for keeping the ocular muscles in the best possible shape.

General hygienic measures will also aid in preventing certain diseases which.

in the years of late middle life, take their toll of eyesight. Some of these are diabetes, hypertension, arteriosclerosis and nephritis. The ocular changes brought about by these diseases do not prevent persons in many occupations from gaining a livelihood, but, in the case of the dentist, often do so. There is no time to speak of the ocular diseases of other types that have the same effect. These should be detected when an examination for glasses is made, at a time when they are amenable to treatment, which is a most important reason that the examination for glasses should be made by one who is a physician first and an ophthalmologist afterwards.

One other subject which should be mentioned is the physical conditions under which dentists work. Most of you realize the value of proper light, but perhaps do not know how much visual efficiency can be increased by this one factor alone. For such work as dentistry, 100 foot-candles of light is none too much at the field of work, and where daylight will not afford this, artificial light should supplement it. Ferree and Rand have recently shown graphically how the symptoms of old sight in persons of late middle age can be reduced by increase in illumination. Some persons who could not read without glasses in ordinary light were perfectly able to do so when the light was increased to 100 foot-candles.

There are many persons in all professions, and a goodly share in the dental profession, who are uncomfortable in their work and who feel that because they have not obtained relief from one examination for glasses, nothing can be done. They may become self-conscious about their symptoms and set themselves down as neurasthenics. While some of them undoubtedly are, the number of these is really small, and most persons can be relieved by proper consideration of the factors just discussed.

CONSERVATIVE MANAGEMENT OF BONE CYSTS IN CHILDREN AND ADULTS*

By A. Y. RUSSELL, D.D.S., Baltimore, Md.

BONE cysts are more prevalent in the maxilla and in the mandible than one would suspect.

Complete extra-oral roentgenographic examination of 600 children under 14 years in Baltimore Public School No. 13 would indicate that one cyst exists in each 200 children examined.

True bone cyst should not be confused with radicular or root-end cyst. Radicular cysts are of inflammatory origin and are found about the roots of pulpless teeth. Teeth are not involved in true bone cysts except by extension pressure due to sac growth.

The cystic membrane or sac, in early life, is lined with secretory cells. When the sac enlarges, it contains more cells. When more cells secrete, the sac becomes larger. Thus, a vicious cycle is formed. Sac growth is due to secretory pressure.

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The gradual pressure of the expanding cyst membrane causes tissue destruction. Teeth and bone are resorbed or forced out of their normal position by such pressure. In most instances, their normal relations will be restored when the cystic membrane is relieved of its internal pressure.

This paper is based on the following fundamental principle: Bone cysts cannot function and grow except by their own internal secretory pressure. When cystic pressure is relieved, the secretory cells cease to function, atrophy and disappear. Mead[1] says: ". . . in very old cysts the lining membrane seems to have disappeared." The appearance of the cystic lining referred to in the quotation is due to the fact that bacterial invasion has taken place and drainage has occurred normally.

A review of the literature on bone cysts reveals little research. Authorities disagree as to the origin of cysts, but agree generally as to treatment. Treatment is almost universally radical. Complete removal of the cystic membrane and the extraction of the adjacent teeth that are apparently involved is the recommended procedure.

Fig. 1.—Left: Cyst before operation. Right: Deformity after radical operation.

Fig. 2.—Left: Extensive cyst of mandible in girl, aged 12. Center: Appearance of jaw six weeks after establishment of drainage. Right: Appearance of jaw four months after establishment of drainage.

To again quote Mead: "The cyst and cyst wall should be surgically removed. . . . Prognosis is favorable if the cyst is removed."

I am familiar with the theory and almost universal belief that unless all the cystic membrane is removed surgically or destroyed by cautery, cysts will recur.

1. Mead, S. V.: Diseases of the Mouth, St. Louis: C. V. Mosby Co., 1928.

It is my purpose to show the fallacy of this theory and to prevent the use of the destructive surgical procedure that has been employed in the past. The destructive operation of the past leaves much deformity to be corrected. The soft tissues collapse because the hard structures have been resorbed. After the teeth are extracted and the lining membrane is removed, insufficient support is left in extensive cases to allow repair to take place without more or less deformity.

After a destructive operation, a corrective appliance, usually in the form of a partial denture with some type of plumper, is required to correct the deformity and keep the soft tissues in their proper places. This can be avoided by a conservative type of cyst management. "There is a wide difference of opinion regarding the classification of cysts."

This paper will not deal with cyst classifications as we know them, nor with causes; but will limit its scope to the more important phase: the conservative management of bone cysts in children and adults. An effort will be made to outline a simple, direct, comprehensive and conservative mode of cystic management that may be followed by the general practitioners of dentistry and surgeons.

Fig. 3.—Left: Occlusal view of case referred to in Figure 2, showing extensive mandibular cyst before drainage. Center: Appearance of case four weeks after drainage was established. Right: Appearance after four months.

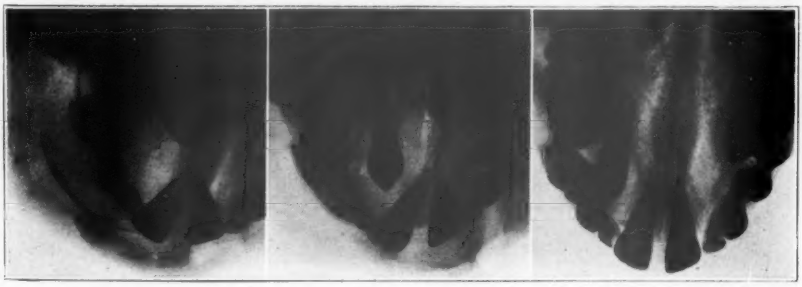

Fig. 4.—Left: Extensive maxillary cyst before drainage. Center: Appearance of case six weeks after drainage was established. Right: Appearance four months after drainage was established. Healing is evident, with migration of the cuspid and repositioning of the central incisors.

The cases shown here (Figs. 1-7) were under my observation and that of my coworkers during the past ten years. No case of cyst recurrence has been noted during this period. Most cases were entirely healed at the end of six months. The

Fig. 5.—Left: Appearance of cyst before treatment. Right: Appearance three months after conservative treatment was established. The cyst is absent and the teeth are rapidly moving into place. (Courtesy of G. C. Karn.)

Fig. 6.—Left: Cyst in patient, aged 65; before drainage. Right: Appearance of case one year after drainage was established.

average case observed was healed at four months. A few extensive cases were kept under observation while healing as long as two years. One case will be shown which has improved but has not completely healed in this period.

In most instances, the bone has grown back to normal. The teeth have returned to former positions and occlusion. In a few cases, surgical and orthodontic treatment was used to promote eruption and normal occlusion. In no case were surgical measures, curettage or removal of the sac resorted to for the purpose of aiding in the treatment.

DIAGNOSIS

Cystic involvement is sometimes discovered by a bulging of a part, but is usually revealed during roentgeno-

graphic examination. This bulging is due to slow progressive sac growth. Roentgenographic examination of the jaws should be both extra-oral and intra-oral. When an area is located by one familiar with the appearance of a bone cyst in the roentgenographic film, the diagnosis is usually fairly conclusive. If one is not sure of the diagnosis, aspiration or exploratory operation may be resorted to.

ASPIRATION

Aspiration of the young cyst will reveal the typical cystic fluid. If the cyst has extended near to the surface, it may contain infective material. Cysts of long standing often contain a brown residue and sometime cholesterin crystals.

Fig. 7.—Left: Extensive maxillary cyst, with supernumerary tooth. Right: Teeth returned to former position, without orthodontic assistance. Regrowth of bone appears normal.

EXPLORATORY OPERATION

An exploratory operation may be carried out by an incision through the mucous membrane and periosteum over the cyst wall. The thin bone, which is exposed by retraction of the tissues, often may be cut with the knife; or a chisel may be used to expose the cystic membrane. A suitable section of the cystic sac can be removed for microscopic study.

CYST MANAGEMENT

After a correct diagnosis, conservative management in these cases consists of careful choice of the anesthetic; draining the cyst; medication of the cystic membrane; postoperative treatment, and maintaining drainage.

ANESTHESIA

Conduction or local infiltration of procaine is the anesthesia of choice. When the conduction method is used, one does not have to consider the site of incision before making an injection; but if infiltration is contemplated, the most suitable place for drainage must be determined. If an unerupted tooth is present, its eruptive site should be selected for anesthesia and incision. For cases in which there are no unerupted teeth, the thinnest portion of the cyst wall for infiltration, that portion nearest the surface in the oral cavity and in a good position for drainage, is selected. Infiltration is carried out to produce anesthesia over not more than an area of 1 inch.

DRAINING CONTENTS OF CYST

In order to drain the cyst, an incision is made in the area under anesthesia. If it is preferred, a circular area about the size of a pencil may be removed. Direct pressure is avoided when the incision is made to prevent the contents from being forced out on the patient and the operator. All cystic fluid is drained out and the cavity syringed out with a warm solution, until the return flow is clear. The mental foramen must be avoided in mandibular incision because of the possibility of hemorrhage and nerve injury.

MEDICATION

Medication of the cystic cavity is not necessary, but, in most cases, mercurochrome or neosievol has been used in the cystic cavity. Mercurochrome, 15

per cent solution, stains and coagulates the cystic secretions and helps to cleanse the walls of the sac.

BUTTERFLY DRAIN

For maintaining drainage, the butterfly rubber dam drain is used. It is made by scalloping or by making slits in the sides of a piece of rubber dam of suitable size. Its appearance is something like that of a headless butterfly. It has proved to be the most satisfactory form of drain. (Fig. 8.)

tends into the oral cavity, speech and muscle action are interfered with. As healing occurs, the drain should be shortened to allow further contraction of the sac.

MAINTAINING DRAINAGE

The secretory cells contained in the cystic membrane continue to secrete for a time, and provision must be made to allow for continuous drainage. The butterfly drain should be wide enough that when it is rolled and placed in the in-

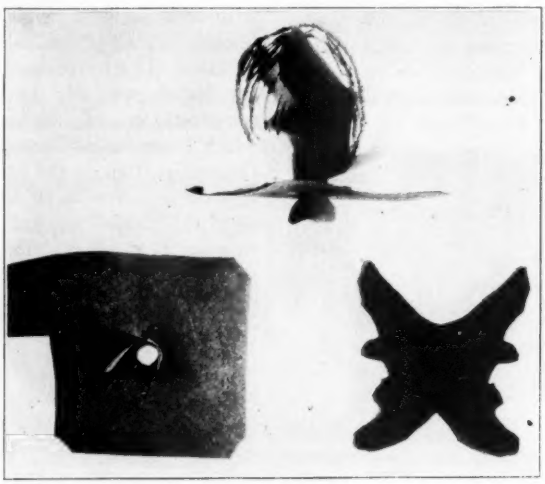

Fig. 8.—Above, butterfly drain extending from incision to posterior wall of cyst. Left, butterfly drain rolled and placed in incision to maintain continuous drainage. Right, butterfly drain cut from rubber dam.

The rubber drain should be long enough to extend from the cyst wall farthest away from the incision, and one or more scallops are allowed to protrude into the oral cavity. If it is made too short, difficulties may arise from the drain's being forced into the cystic cavity during mastication and deglutition, when too long blockage occurs and drainage is interfered with. If too much excision, one or two thicknesses will remain rolled to exert pressure and maintain the opening for drainage. Drains properly placed should not present difficulties; but, with the best of care, they sometimes are lost out of or forced into the cystic cavity. In the latter case, the drain may be recovered by the use of a very fine sharp, hooked explorer, No. 19. This explorer is passed through the in-

cision into the cystic cavity to engage the lost drain. When the rubber is so engaged, it may easily be removed through the incision without further operation.

When the edges have healed about the drain so that the incision will remain open and allow continuous drainage, the butterfly drain may be left out. If the opening shows a tendency to close the drain should be replaced for a time. The drain may be left in for several days or may be changed at each sitting. The average time that the butterfly drain is used is about one week.

The patient should be seen daily for about three days, and after progress is noted, longer intervals may elapse between sittings. At each sitting, the cystic cavity should be syringed, until the return flow of fluid is clear.

The sac becomes smaller and holds less fluid as time goes on. When force is applied by the syringe, the patient will notice a fullness and stretching sensation. This stretching of the sac helps to cleanse the walls and aids in healing.

This method allows the bone to be redeposited normally behind the walls of the cystic sac, and finally the entire cavity is filled with normal bone. The time consumed in bone growth depends on the size of the cavity. The teeth forced out of alinement soon resume their former positions. The unerupted teeth are allowed to erupt normally. Orthodontic treatment occasionally is indicated, but, in most cases, the teeth return to their former positions unassisted.

SUMMARY

Cysts can be successfully treated without radical operation.

When internal cystic pressure is relieved, the secretory cells atrophy and disappear.

Bone is deposited normally behind the contracting cystic membrane, and finally the entire cystic cavity is filled with normal bone.

No recurrence of the cyst has followed this type of treatment.

Further research should be undertaken on causes and classification of cysts.

2128 St. Paul Street.

A STUDY OF TWENTY-FOUR CASES OF MOTTLED ENAMEL IN A FLUORINE-FREE-WATER DISTRICT

BY R. REED SMITH, D.D.S., Springfield, Mo.

CONSIDERABLE interest has been shown in mottled enamel during the past few years. Its world-wide occurrence makes it a complex problem of more than usual interest to the laity as well as the dental profession. In addition to its widespread appearance in America, it has been reported in several countries in Europe, Africa, the Argentine, China and Japan.

Fluorine was discovered in 1832 by F. S. Beaudant. Seventy-six years later, G. V. Black discussed the subject of mottling of the enamel and its possible cause, but he had not at that time discovered the significance of fluorine and its relation to mottled enamel. Fluorine is an element classed among the halogens, resembling chlorine somewhat, though it is the most active of all elements, and

Patient	Native Born	Childhood Diseases	Appearance of Gum	Source of Water	Special Treatment or Medication	Improvement	Appearance of Enamel	Bottle or Breast Fed	Classification (Dean's)
1	Yes	Usual diseases, diphtheria with high temperature	Normal	City	Carefully supervised diet, high in calcium; violet ray treatment; cod liver oil	Marked improvement	Slightly rough	Bottle	Questionable
2	Yes	Usual diseases	Normal	City	None	None	White pits	Bottle	Very mild
3	Yes	Usual diseases	Normal	City	None	None	White pits	Bottle	Mild
4	Kansas	Usual diseases, scarlet fever, high temperature	Hypertrophy	Well	Diet, cod liver oil	None	Colorless pits	Breast	Moderate
5	Colorado	Mumps only	Normal	City	None	None	Brown	Bottle	Very mild
6	Yes	Usual diseases	Normal	Well	None	None	White pits	Bottle	Mild
7	Yes	Usual diseases	Hypertrophy	City	None	None	White spots	Bottle	Questionable
8	Yes	Diphtheria, high temperature	Normal	City	None	None	Brown pits	Bottle	Moderately severe
9	Yes	Scarlet fever only	Normal	City	None	None	White pits	Bottle	Moderate
10	Yes	Usual diseases	Normal	Well	None	None	White pits	Bottle	Mild
11	Yes	Usual diseases, typhoid at age 10, high temperature	Hypertrophy	City	None	None	Brown pits	Breast	Moderate
12	Yes	Usual diseases	Normal	City	Carefully supervised diet,	Slight	White	Breast	Mild

		age 10, high temperature					Brown pits		
12	Yes	Usual diseases	Normal	City	Carefully supervised diet, high in calcium	Slight	White pits	Breast	Mild
13	Yes	Usual diseases, pneumonia at age 8, high temperature	Pyorrhea	City	None	None	Brown pits	Bottle	Very mild
14	Yes	Usual diseases	Normal	City	None	None	Colorless pits	Breast	Moderate
15	Yes	Usual diseases	Pyorrhea	City	None	None	Brown pits	Breast	Moderate
16	Yes	Usual diseases, scarlet fever at age 11, high temperature	Vincent's infection	City	Supervised diet, cod liver oil	None	Brown pits	Breast	Mild
17	Yes	Usual diseases	Normal	City	None	None	White pits	Breast	Mild
18	Yes	Usual diseases, pneumonia at age 10, high fever	Hypertrophy	City	Vegetable diet; cod liver oil, about 8 years; calcium lactate, about 3 years	Slight	Brown pits	Bottle	Moderate
19	New Mexico	Usual diseases, scarlet fever at age 7, high temperature	Pyorrhea	Well	None	None	Brown pits	Bottle	Mild
20	Yes	Usual diseases, diphtheria at age 3	Normal	City	None	None	White pits	Breast	Moderate
21	Yes	Scarlet fever, mumps	Normal	City	None	None	Brown pits	Bottle	Mild
22	Yes	Usual diseases	Normal	City	None	None	Colorless pits	Bottle	Moderate
23	Yes	Usual diseases	Normal	City	None	None	Brown pits	Breast	Moderate
24	Utah	Usual diseases, diphtheria, high fever	Normal	City	None	None	Brown pits	Bottle	Mild

rapidly attacking glass and most all metal. It is found in the human body in the bones, teeth and brain. The teeth contain from 0.33 to 0.59 per cent. Fluorine is also found in vegetables and fruits and in the yolk of eggs. H. P. Talbot reported that fluorine is found in malt liquors, most malt beers containing not less than 0.2 mg. per liter. The able and scientific studies of Smith, Lantz and Smith[1] presented before the Chicago Dental Society in February, 1934, seem to have established the fact that the presence of excessive amounts of fluorine in the water supply is one of the causes of mottling of the enamel. It is an accepted fact that the mottling of the enamel found in the Arizona basin is caused by the destructive action of the fluorine in the water supply. Twenty-three states have reported traces of fluorine in their water supplies. This might be caused by the periodic and severe droughts that lower the water and increase the amount of dissolved salts, allowing fluorine to enter the water supply. Seepage through rock phosphate, which has a high fluorine content, will also give a troublesome amount of fluorine.

In a locality where the water supply is free of fluorine, I have found only twenty-four cases of mottled enamel within the last five years. After a record and brief history of these cases has been kept and tabulated in a form for study purposes, as given in the chart, it would appear, from conclusive study, that there are causes for the mottling of enamel other than the presence of fluorine in the water supply, as, otherwise, there would have been a far greater number of cases of mottled enamel brought to my attention. Two facts are significant from my study of these twenty-four cases. 1. There is some other means by which fluorine, or a combination of fluorine, enters the system than by the water supply. 2. There is a possibility that some other chemical altogether apart from fluorine might, under certain favorable conditions, cause mottling of enamel.

It is reported from an authoritative source that 1 part per million of fluorine in drinking water is necessary to produce mottling of enamel in human beings, although the fluorine has to be absorbed during the period of calcification before it has any effect on the enamel of teeth; that is, any time from birth to perhaps 12 years of age. From information obtained from apple growers of this section of Missouri, I have learned that, in the past, an insecticide spray was used that had an average fluorine content of 5.6 parts per million, as analyzed.[2] Thus, one large apple would contain approximately as much fluorine as three or four glasses of water which contained the damaging concentration of one part per million of fluorine. This part of Missouri produces and consumes a large quantity of apples, which might explain, to some extent, the presence of mottled enamel in this locality.

At the present time, mottling of enamel presents a baffling question to the dentist. He is unable to offer a possible treatment and can only explain its cause in a somewhat limited way. If records were kept by the dentist in regard to this condition as he finds it and reported to the American Dental Association, a classification might result that would increase the knowledge of the dental profession on a perplexing subject.

The chart shows several interesting findings.

All but four of the twenty-four chil-

1. Fluorine Toxicosis with Special Reference to Effect on Teeth. (Unpublished data.)

2. Jared, C. R., E. J. Newcomer: Studies of Fluorine Compound for Controlling Coddling Moth, U. S. Dept. of Agr. Tech. Bull. 373, 1933.

dren showing mottled enamel were native born. Twenty of the patients used city water.

Patient 1 really first brought my attention to mottled enamel because of her interesting history. She was the daughter of a physician. Her father and family dentist recognized the condition as mottled enamel at the age of 12. The father took her to several clinics in different cities. She was given treatment over a period of about three years of ultraviolet rays and a strictly supervised diet high in calcium and with an abundance of cod liver oil. She was 16 years of age when brought to my attention, and, according to her father and her former dentist, the condition of mottled enamel was much improved. At the present time, the enamel is only slightly rough and I have classified it according to Dean as very mild or even questionable. Something brought about an improvement. Could it have been the carefully supervised diet and treatment?

Most of the worst cases of mottled enamel were associated with high and prolonged fever, such as is found in diphtheria and scarlet fever. Could these high temperatures have had any part in affecting the formation of the teeth and in the depositing of calcium?

The remaining four patients who are trying some treatment in an endeavor for improvement have not had sufficient time as yet to show any results. Of course, it is quite probable that they will not derive any benefit or show improvement.

There seems to be no significance in the type of early feeding; i.e., as to whether the patient was bottle fed or breast fed.

222 East Commercial Street.

GENERAL ANESTHESIA AS IT MAY INTEREST THE GENERAL PRACTITIONER, WITH SPECIAL CONSIDERATION OF NITROUS OXIDE-OXYGEN AND ETHYL CHLORIDE*

By MAX H. JACOBS, M.D., D.M.D., Boston, Mass.

THAT the dentist is becoming more interested in general anesthesia is manifested in three ways: 1. There has been an increase in the sale of the modern gas apparatus, in spite of the economic depression. 2. There has been a tremendous increase in the number of general practitioners taking postgraduate training in general anesthesia. 3. There is a ready market for discarded gas machines.

This has been brought about because (1) many patients are demanding a general anesthetic, having been informed that, under its effect, there is no mental or physical pain; (2) there are definite indications in the dental office for general anesthesia, and (3) much has been written recently on the newer anesthetics administered intravenously, rectally or orally.

As a result, many dentists have been forced to include nitrous oxide-oxygen in their anesthetic armamentarium. In so doing, they have encountered many discouraging conditions.

*Read before the Massachusetts Dental Society, Boston, Mass., May 1, 1936.

It is the purpose of this paper to discuss these conditions through a series of questions from general practitioners and to offer suggestions that may help eliminate or reduce the problems involved.

The more common of these questions are: 1. How and where can I procure training in general anesthesia? 2. Why do I encounter difficulties during the induction of nitrous oxide-oxygen? 3. Why is vomiting so common during general anesthesia? 4. When shall I give nitrous oxide-oxygen to a patient? 5. Shall I use carbon dioxide? 6. Shall I employ medication before administering nitrous oxide-oxygen? 7. Shall I give gas to children? 8. Is the use of ethyl chloride dangerous and have there been any changes in its use? 9. Is there an indication for the newer anesthetics in the dental office?

How and where can I procure training in general anesthesia?

There are three sources from which one may procure training in general anesthesia: the dental school, the hospital and private instruction.

With few exceptions, the dental schools of this country have not yet recognized the ardent need for intensive training of their students in general anesthesia. As a result, graduates have absorbed what little they have observed and have attempted the administration of a general anesthetic unsuccessfully. This accounts for the number of discarded gas apparatus. Some graduates have supplemented their school knowledge with the commercial salesman's instruction. These men, also, have been unsuccessful. It seems that graduates often cannot turn to their Alma Mater for further study, because the number of dental schools offering postgraduate courses in general anesthesia is limited.

Hospitals, under competent supervision, are the ideal source for training. Unfortunately, two facts militate against this: 1. Dental anesthesia differs from that of general surgery, the former being practically nasal administration and the latter through the mouth and nose, which are completely covered at all times. 2. Hospital anesthetists can neither spend the time nor secure the cases; nor can they properly take care of the number of dentists who might avail themselves of the opportunity of such training.

There remain, therefore, the private teachers, many of whom are sufficiently competent to teach not only the fundamentals of anesthesia, but also every phase of it. These instructors have failed to recognize one important fact: There are certain persons who, no matter how much training in general anesthesia they may have had, or how great their theoretical knowledge may be, can never become good dental anesthetists. They lack what is termed the "anesthetic sense." These persons are continually taking courses, but the more anesthetics they administer, the more difficulties they encounter. They must be discouraged from administering nitrous oxide-oxygen and limit themselves entirely to local anesthesia or call in an expert anesthetist.

Why do I encounter difficulties during the administration of nitrous oxide-oxygen?

The answer to this question may be divided into two parts: mechanical shortcomings and an incorrect classification of patients.

My observations of general practitioners administering nitrous oxide-oxygen to patients have been interesting and have disclosed many mechanical difficulties. Among these are defects in gas machines because of dry, cracked rubber, open joints and leaking valves; the use of too large or too small a nasal inhaler or incorrectly placed throat curtains; an

incorrect position of the head, causing respiratory embarrassment, and faulty manipulation of the hands and fingers during operation.

To correct these mechanical faults is an easy matter. The rubber tubing and rubber bag must be frequently moistened. Not only does this increase the durability, but it also aids in preventing explosions, for mixtures of nitrous oxide-oxygen have been known to explode in too dry an atmosphere or where there is too much static.

Open joints and leaking valves alter mixture percentages. A large nasal inhaler permits an ingress of air. A small one may impinge on the nares, shutting off nasal respiration.

A throat pack or curtain incorrectly placed is one of the most common means of disturbing an otherwise smooth induction. It must not permit an ingress of air and must be inserted when the gag reflex is obliterated. If it is inserted sooner, gagging, retching or vomiting results.

The greatest factor in the success of an anesthesia is an open airway. The occiput, shoulders and back should form a straight line. A V-shaped space between the head and shoulders causes a muscular impingement on the larynx or trachea, with embarrassment of respiration and cyanosis. This may, of course, be avoided by the use of intranasal or intratracheal catheters; which has no practical value in a dental office.

The operator himself is many times responsible for lack of a smooth maintenance stage during general anesthesia. With his hands or fingers, he may shut off the glottis by pushing the tongue backwards or cover the glottis with the throat pack. The patient becomes cyanotic. The assistant, noting this, employs straight oxygen, disrupting the gas percentages which evidently were indicated.

Difficulties are also encountered during the administration of nitrous oxide-oxygen because of incorrect classification of patients.

The sooner general practitioners recognize the fact that not all patients are susceptible to nitrous oxide, the sooner will many difficulties be eliminated. Hyposusceptible patients may be taken care of in hospitals, but it is a different matter in the dental office. Alcoholics, athletes, patients suffering from hyperthyroidism and drug addicts can best be anesthetized with nitrous oxide-oxygen by experts, who, many times, in spite of their experience, have to resort to ether or some other anesthetic.

There are nonsusceptible patients even among the normal. A small, frail woman may become a terror under the influence of nitrous oxide, and a robust outdoor worker may prove very mild. The ability to properly classify patients is an important factor in the successful use of nitrous oxide-oxygen anesthesia.

Why are nausea and vomiting so common during nitrous oxide-oxygen anesthesia?

The more common causes of nausea and vomiting are (1) the presence of food in the stomach; (2) too light anesthesia; (3) too deep anesthesia, and (4) swallowing of blood or mucus.

Nausea and vomiting may be controlled by: 1. Having the stomach empty. Instead of giving gas to any patient who enters the office at any time, an appointment should be made at least two or three hours after a meal. 2. Employing oxygen is a stimulant. If one were to breathe oxygen for a period of time, he would become dizzy and nauseated, apnea ensuing. Too light anesthesia with too large a percentage of oxygen in the gas mixture, results in prolonged stimulation of the nausea and vomiting centers. 3. Avoiding too deep anesthesia,

which results in a toxic irritation of the vomiting centers. This is generally associated with jactitation, which may be the forerunner of vomiting during the anesthesia. 4. Avoiding swallowing of blood during the recovery stage of gas anesthesia. Operative wounds should be kept covered with gauze under pressure until all reflexes have returned.

There are some patients who very easily become nauseated. The patient who cannot travel by boat because of seasickness is in this class. Such a patient must be informed of the possibility of nausea and vomiting during or after nitrous oxide-oxygen anesthesia.

When shall I give nitrous oxide-oxygen to a patient?

In the discussion of this question, it must be understood that the general practitioner is the one to be considered. I believe that nitrous oxide is indicated in acute, subacute and chronic infections in which infiltration or conduction anesthesia may spread existing infection. Extremely nervous persons, who suffer mentally and in whom it is best to cut all association paths to the brain as quickly as possible, are better off with a general anesthetic, if susceptible to the anesthetic. Nitrous oxide-oxygen is indicated in the general practitioner's office for patients who have certain types of heart disease in which an anginal attack may be precipitated psychologically, or through the use of some vasoconstrictor.

Shall I employ medication before administering nitrous oxide-oxygen?

This depends upon two things: (1) the individual reaction to the premedicating agent, and (2) whether the patient is accompanied to the office by some one who will make certain that he returns home safely.

Individual reaction varies, depending on the type of premedicating agent used. Those in common use today are nerve sedatives, narcotics and barbiturates. The two former ones are gradually being replaced by the last, and herein lies a story.

The barbiturates may cause delirium and restlessness in some patients or prolonged somnolence in others. Pentobarbital sodium (nembutal) has been the most effective barbiturate in my practice. Its effects are not so prolonged as those of other barbiturates and it does not have the so-called "hangover," if given in a 1½ grain dose for premedication.

For prolonged operations, premedicating agents are indicated. Their use cuts down the amount of anesthetic necessary, permits a larger percentage of oxygen and helps, to some extent, to quiet the overstimulated type of patient.

On the other hand, premedication in the dental office for short operations is unwise, especially if the patient is to return home alone.

Shall I give gas to children?

Opinions vary as to this. Some experts believe that children under 6 years of age should not be given nitrous oxide because of instability of the nervous system and the possibility of status lymphaticus.

My experience has been different. In looking over the records at the Forsyth Dental Infirmary, I found that in 2,704 nitrous oxide cases for extractions up to Jan. 31, 1936, there were no untoward results. In 14,397 nitrous oxide-oxygen-ether administration for tonsillectomy and adenoidectomy, there was no anesthetic fatality.

The value of nitrous oxide and oxygen in children is best determined by the fact that approximately fifty tonsillectomies were performed under straight nitrous oxide and oxygen, 50 per cent being given sodium amytal before anesthesia. These operations were performed successfully without a fatality in spite of the most adverse anesthetic conditions. It must be realized that the postnasal spaces in these

children were filled with obstructive adenoids and that the throats were blocked with hypertrophied and diseased tonsils. The ages of the children in all cases ranged from 2½ to 13 years. In 17,151 children given nitrous oxide-oxygen for extractions or tonsillectomies or as an induction to ether, there has been no anesthetic fatality or untoward result.

For a number of years, children were examined by the roentgen rays for enlarged thymuses. When a suspicious suprasternal shadow was found, the child was given roentgen therapy before operation. For the last eight or nine years, we have not employed the roentgen rays on children, but have proceeded to anesthetize and operate on them. The results have been no different. The thing to guard against in children is psychic shock. Their confidence must be gained and they must not be "scared to death."

In my opinion, nitrous oxide-oxygen is a safe anesthetic for children.

Shall I use carbon dioxide?

Let us study the physiology of carbon dioxide and the indications for its use in the dental office. Carbon dioxide exists in solution in the blood to the extent of about 3.5 to 5.5 per cent. Its presence is essential to respiration, stimulating the respiratory centers in the medulla and controlling the depth of respiration. As carbon dioxide is withdrawn from the circulation, the respiratory centers are depressed and respiration becomes shallow. When all carbon dioxide has been exhausted, the centers become paralyzed and respiration ceases. The cessation of respiration as a result of the absence of carbon dioxide is known as acapnia.

If one were to remain in an atmosphere of pure oxygen for several minutes, he would become somewhat nauseated, undergo vertigo and then cease breathing. In an atmosphere supersaturated with oxygen, insufficient carbon dioxide is permitted to form, respiratory depression resulting. Cessation of respiration as a result of too much oxygen is known as apnea.

We find, therefore, that breathing may cease as a result of too little carbon dioxide (acapnia) or too much oxygen (apnea). True apnea is due to acapnia. (Howell.)

This is one of the reasons that under prolonged ether anesthesia a patient will stop breathing, although the color is good and the pulse is within normal limits. Occasionally, this occurs in nitrous oxide-oxygen anesthesia. A patient may undergo extreme emotional excitement resulting in such rapid breathing that the carbon dioxide is eliminated and the carbon dioxide content of the blood is lowered, respiration becoming shallow or ceasing.

The operations performed by the general dental practitioner are usually short. Rarely does a patient become apneic or acapniac. If a premedicating agent is used, especially morphine, respiratory depression, with shallow breathing, may occur. Here, the use of carbon dioxide is indicated to increase the depth of respiration. Carbon dioxide administration does not increase the rate of respiration.

Carbon dioxide may be administered in one of three ways: (1) rebreathing; (2) administration of pure carbon dioxide through a tank, and (3) administration of carbo-oxygen.

Rebreathing is accomplished by shutting off both the air valve and the exhaling valve in the nasal inhaler, permitting the exhaled air to enter the mixing chamber and thus be rebreathed. The exhaled air contains the products of gaseous metabolism and consists of carbon dioxide and other impurities. This means that occasionally the exhaling valve must be opened to permit the es-

cape of the impurities and rebreathing started again.

From 3 to 5 per cent pure carbon dioxide may be given directly through a tank.

Carbo-oxygen, a mixture of 95 per cent oxygen and 5 per cent carbon dioxide, may be used in place of pure oxygen or pure carbon dioxide, and the necessity of rebreathing be eliminated.

Carbon dioxide is a valuable adjunct to nitrous oxide-oxygen, and though it need not be used for short operations, its use will stimulate respiration in those persons who are naturally shallow breathers or those who have been given premedication. It is also of some value in the overstimulated type of patient. The increase in the depth of respiration increases the rate of absorption of nitrous oxide, decreasing the length of or eliminating the excitement stage.

Is the use of ethyl chloride dangerous?

In the *Dental Cosmos,* September, 1930, I reported 123,210 cases of ethyl chloride administrations by inhalation to children ranging from 3 to 14 years of age, at the Forsyth Dental Infirmary, for extraction of deciduous teeth and other minor surgery.

In THE JOURNAL, June, 1933, I reported 26,388 additional cases, making a total at that time of 149,598 ethyl chloride administrations. I am now ready to report on 44,796 more cases, making a total of 194,304 up to Jan. 31, 1936. A series approximating 200,000 cases is sufficiently large to furnish definite information. Let us analyze this series and find the danger, if any, in the administration of ethyl chloride.

In 1915, when we first started to use ethyl chloride for extraction of deciduous teeth, it was employed in large enough quantity to produce primary anesthesia. We were able to extract six, eight or more teeth in a period of a few minutes. Several minutes was required for the patient to recover. This was followed, in a large number of cases, by prolonged nausea or vomiting. There is no record of a death or inability of the patient to return to school or to his home.

In 1923, we began to reduce the amount of ethyl chloride, producing a state of deep analgesia rather than primary anesthesia. The number of cases of nausea and vomiting decreased. We found that practically the same amount of operating could be accomplished, and there was a shorter recovery period.

As the years elapsed, the amount of ethyl chloride used per patient has been reduced to such an extent that rarely does an induction period last over forty to fifty seconds. The operating time has, of course, been shortened, the extractions being limited to two or three teeth. Rarely is there nausea or vomiting and the recovery period is a matter of seconds. Analgesia only is produced and no attempt is made to produce anesthesia.

Since 1932, we have noted an interesting phenomenon. Those patients operated on before the analgesic stage has been reached have squirmed and sometimes cried or otherwise manifested signs of pain. Investigation has proved that, ten minutes after recovery, the child has no recollection of the teeth having been extracted.

In view of these findings, I am now working on a technic whereby the child can hear me talk and reacts to suggestion, in having the temporary teeth removed and yet experiences no pain during the procedure. This technic will be reported as soon as a sufficient number of patients have been operated on sucessfully to warrant its description.

Is there an indication for the use of the newer anesthetics in the dental office?

The newer anesthetics are of three kinds: inhalation, rectal and intravenous.

The inhalation anesthetics are ethylene, cyclopropane and divinyl oxide (vinethene).

Ethylene has been in use since 1923. Its explosibility is well known. In order to use this gas safely, certain rules must be followed. The humidity of the room must be high. The floor of the operating room should be covered by a grounded metal plate. The gas apparatus must be grounded, as well as the dental chair. M. Hillel Feldman, of New York, uses ethylene routinely without these precautions and has had no accident. He believes this is due to the fact that the gas he employs is water washed. He uses a Gwathmey apparatus. It is of interest to note that a number of clinics and hospitals have discontinued the use of ethylene.

Cyclopropane is also a dangerous gas because of its intense explosibility. This is unfortunate, since 80 to 90 per cent oxygen can be given with the gas. Relaxation under its influence is marked and recovery is rapid. It may be used instead of ethyl chloride in dental surgery, but its cost is much greater. A great deal will have to be known about its physiologic action and contraindications before its use in the dental office can be considered.

Tribromethylalcohol (avertin) is administered rectally. It is a basal anesthetic, and whenever I have used it in hospital practice, nitrous oxide or ether had to be used in supplement. It has no place in the dental office, first because of the mode of administration and, secondly, because of the questionable recovery time. Some patients may sleep for several hours and must be under constant supervision during this time. This is too much to expect in a busy dental practice, and for short dental operations there are more advantageous anesthetics.

The intravenous anesthetics are sodium amytal, evipan and thionembutal.

Sodium amytal is also a basal anesthetic. When it is given intravenously in large enough dosage to produce complete anesthesia, its mortality rate has been high. Used as a basal anesthetic, supplemented by nitrous oxide or oxygen, its use has been curtailed owing to a degree of delirium in certain patients in the recovery stage.

Evipan, a barbituric acid derivative, also an intravenous anesthetic, has been found to be more satisfactory in hospital practice. Recovery from its effect is supposed to occur within fifteen or twenty minutes after its administration. I have seen the recovery stage last over a period of several hours. In one case, recovery was not complete for twenty-four hours. If the dental office is not equipped to take care of such a patient, no intravenous anesthetic is indicated.

Thionembutal, which will be put on the market as sodium pentothal, given intravenously, is the most rapid acting of this type of anesthetic. I recently had occasion to remove an upper impacted third molar under thionembutal. As soon as a few drops of the solution had been injected, the patient was completely anesthetized. The pupils were widely dilated and the pupilary reflex gone. On injection of a few more drops, relaxation was so complete that the tongue had to be held from closing the glottis. The anesthesia lasted for eight minutes, the pupils becoming smaller and the pupilary reflex returning as the patient recovered. At the present time, it is a too rapid acting anesthetic to be used in a dental office, if a difficult extraction is to be performed.

There is no indication for the use of any intravenous anesthetic in the office of the general dental practitioner. Asepsis must be complete to avoid superficial or blood infection. The chance of

an air embolus in inexperienced hands is forever present. If intravenous anesthesia is used, a recovery room, with an assistant in constant service, must be provided.

CONCLUSION

For general anesthesia in the dental office, nitrous oxide-oxygen is by far the most satisfactory of the anesthetics. Induction and recovery are rapid. Although the margin of safety is narrow, nitrous oxide can be readily displaced by oxygen, since it forms a physical mixture with the blood.

Frank W. Rounds has often stated, and justly so, that nitrous oxide-oxygen is practically the only anesthetic for which we have a specific antidote; that is, oxygen.

Ether affords the widest margin of safety. The induction and recovery periods are slow. The dentist has neither the legal nor the moral right to send a patient out of the office after ether anesthesia, until it has been eliminated from the body. The possibility of ether pneumonia or lung abscess must be considered. If an operation is long enough or severe enough to justify the use of ether, the patient should be hospitalized.

Ethyl chloride is too dangerous a drug to gain complete anesthesia. The mortality is too high. As an analgesic for children in minor dental surgery, it is not only safe, but also expedient.

The dental profession has given to the world two anesthetics in nitrous oxide and ether that have stood the test of time. Other anesthetics have come and gone. If the safety of the patient is to be considered, the newer anesthetics must be left to those most qualified in the field of experimental research. Out of the midst of the present chaos, some anesthetic will at some time or other stand out because of its safety and efficacy. Until then, let us adhere to the old adage, "Be not the first by whom the new is tried, nor yet the last to lay the old aside."

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GENTLE MEANS FOR REDUCING FRACTURE

By CARL F. MORGENTHALER, D.D.S., Hammond, Ind.

OVERCOMING muscular antagonism is perhaps the most difficult problem arising in the reduction of fractures of the mandible. Without this problem, fracture reduction would be greatly simplified. It would be as easy as assembling the different parts of a box that are to be nailed or glued together. The muscles of mastication play a definite part in creating this resistance, a part which varies with the site and extent of the injury. Owing to the position of the muscle fibers, contraction or relaxation is always in the direction of the long axis of the muscle. A muscle in contracting is shortened and in relaxing is lengthened. It follows that the muscles which exert a downward pull on the mandible are those that are attached to the body of this bone, and run in a downward direction, and that those muscles which exert an upward pull are the ones that are attached to the mandible and run in an upward direction.

This is stated merely to emphasize the fact that we must first recognize which group of muscles are exerting a force, that we may apply a counterforce to overcome this action. Disregarding the impacted fracture, wherein one fragment is driven into another, we might say that muscular antagonism is the only force with which we have to deal. This muscular antagonism or "pull" has two sources. The injury that is responsible for the fracture always produces a certain amount of trauma to the investing tissues, with resultant swelling, soreness and stiffness. There is an infiltration of the tissues with blood and tissue juices.

All of these conditions produce a certain tenseness or contraction of the adjacent muscles. This tenseness of muscular and adjacent tissues exerts a force that holds displaced bone fragments out of alinement and prevents them from assuming their normal position. We speak of muscular pull and contraction; but it is extremely doubtful that any fragments are ever drawn out of position by this pull. Rather, they are displaced at the time of the accident and held in malalinement by the slight contraction of the muscles, which is caused solely by the swelling of injured soft tissue.

This is perhaps not in accord with most teachings, yet there is evidence to support this assertion. For instance, many times, a long edentulous posterior fragment of the mandible has been observed with complete fracture, yet in alinement when the force that produced the fracture was not of extreme violence; that is, not violent enough to injure soft tissue very badly and cause displacement of the fragment. Even after a week's time with no treatment, the muscular pull does not displace this fragment. From its origin to its insertion, no normal muscle in the body is stretched tightly when relaxed. If it were, there could be no relaxation; and relaxation is not a function: it is a complete dysfunction. The rest position of the mandible finds the muscles of mastication relaxed and the mandible falls of its own weight until the slack of muscles or tissues is taken up.

Recently, a case was observed of complete fracture of both condyles. A young woman jumped from a second story window, alighting on soft ground and receiving a great deal of the force of the fall on the face, especially the chin. Roentgenograms of the condylar regions revealed complete fracture and displacement of both condyles. There was loss of occlusion and swelling in front of both ears in the temporomandibular regions. It seems more reasonable to assume that the condyles were displaced by violence, that is, that the mandible was driven backward and the broken condyles were caught and held out of position, than that the external pterygoid had exerted more of a pull than the extremely tough capsular ligaments.

Witness also the relaxation of surgical anesthesia with the complete loss of muscle tone. The mandible may be freely moved with little effort and the lifted arm falls as a dead weight. The broken long bones of the leg must be slowly pulled into position, but there has first been violence to cause displacement.

There is another cause of muscular contraction which may be called hysteria. The muscles of mastication, of expression and of the neck are all held rigidly, much the same as when there is a boil on the back of the neck. The patient is afraid to move for fear of causing pain. This hysterical condition was expressed quite aptly by one patient who said he was afraid his jaw would drop off if he did not hold his muscles rigid. When support is applied by some appliance, a sense of security is given the patient,

hysteria vanishes and relaxation is secured. When relaxation is apparent, reduction can be completed with little pain or trauma. Seldom will it be necessary to use even premedication. This relaxation will occur in from twenty-four hours to as long as three or four days from the time the initial support is given to the bone fragment.

The best method to use in reduction is the one with which the operator is most familiar and has used with success previously. Many different kinds of appliances have been devised for fracture reduction, some so complicated as to be totally useless in the hands of any one except the originator. The vast majority of cases can be handled by very simple methods, and only in unusual cases is it necessary to resort to anything out of the ordinary.

Whatever contrivance is used should be applied as soon as possible without, necessarily, an attempt to secure complete reduction at once. Let us say a "half-way" reduction is obtained in any case in which stubborn muscular resistance is present. The next day, a little better alinement is accomplished, and so on, until, within four or five days, complete reduction is secured. This method is much more comfortable to an already distressed patient and can be applied with very little pain. Then also, there is no necessity for a general anesthetic. Many times, the retching and straining on recovery from anesthesia are too great a strain on the appliance used, and our work has been done for nothing.

Heroic pressure in reducing a fracture is not necessary. Gentle manipulation of tissues already outraged will relieve the unfortunate patient from additional shock and pain. It is very gratifying to observe the favorable reaction of both patient and painful tissues when reduction is carried out gradually and gently.

ARTHRITIS, A DENTAL PROBLEM*

By GEORGE F. O'BRIEN, M.D., Chicago, Ill.

REQUESTING a physician to tell the dental profession what they should know about arthritis is presuming that the medical profession knows a great deal about it. Careful reflection brings one to the realization that the story of arthritis is one of chaos, abounding in conflicting ideas and theories, interspersed here and there with a few facts. It shall be the purpose of this paper to bring out some of the leading trends of thought, without attempting to put the stamp of finality on any of them.

Arthritis is a chronic generalized systemic disease in which the most obvious symptoms and signs are in the joints. Unfortunately, its name has attracted too much attention to the joints, with a corresponding neglect of perhaps its more important systemic reactions. Approximately 4 per cent of the population in the north temperate zones are afflicted with

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arthritis. No other disease produces the physical disability and the invalidism and causes the loss of time from work that arthritis does. Consequently, it deserves the serious attention of all health-promoting groups.

Much confusion has arisen in the literature over the terminology of chronic arthritis. The layman and far too many professional men term it rheumatism. The British committee appointed for the study of arthritis divided chronic arthritis into two groups based partly on etiologic, but mostly on pathologic, grounds. They spoke of rheumatoid arthritis, probably infectious in origin, and osteoarthritis, presumably degenerative. In America, a similar committee has subdivided chronic arthritis into a proliferative and a degenerative type, corresponding to rheumatoid arthritis and osteoarthritis, respectively. Other terms which are met are infectious arthritis, arthritis deformans and atrophic arthritis, corresponding to rheumatoid arthritis, and hypertrophic arthritis, corresponding to osteoarthritis. Because of the more general use of the British classification, it will be adhered to in this paper.

First, consider the problem of osteoarthritis: What are its etiologic factors and what is its relationship to rheumatoid arthritis. Pathologically, changes are seen to occur first in the articular cartilages. The fibrils become more prominent; fibrous tissue is laid down between the fibrils, and gradually there occurs a fibrillation and a cracking of the cartilage. As if to compensate for the damage done to the articular surface, there next appears an overgrowth of cartilage at the joint margins. These ultimately become ossified and form osteophytes, irregular firm areas of swelling readily recognized in the terminal joints of the hands and termed Heberden's nodes. In addition, there is an increase in density of the subarticular bone due to an osteosclerosis. These pathologic findings are almost identical with those seen in a senile joint or in a joint after trauma.

Trauma, then, is the first point to consider in the etiology of osteoarthritis: not gross trauma, but those slight repeated injuries that affect certain joints of each and every one of us, the result of everyday use and misuse of the joints. Keefer[1] made a study of the knee joints in 100 cadavers. In the first two decades of life, he found no changes. From 20 years to 30 years of age, changes appear rapidly, 60 per cent showing signs of degeneration; while in those between 30 and 40, 90 per cent showed definite osteoarthritic or degenerative signs. If trauma, then, is such an important factor in osteoarthritis, it should affect predominantly those joints that are subjected to the greatest strain; namely, the weight-bearing joints, and those that are strained because of work, deformities, injury and infection. Clinically, pathologically and roentgenologically, this is true. Thus, the knee and hip joints are involved in the obese and those with flat feet, bowlegs and knockknees. The spine is involved in those with poor posture and with deformities resulting from disease, and the temporomandibular joint, in those with ill-fitting plates and bridges, malocclusion, molars missing on one or both sides or frequent dislocation of the jaw.

Furthermore, in laboring groups, there is a definite tendency for those doing the same type of work to develop arthritis in the same group of joints: the blacksmith in the wrist, elbows and shoulders; the marathon runner, in the knees and hips; the seamstress, in the fingers. In-

1. Keefer, C.: Classification and Certain Pathological Defects of Chronic Arthritis, New England J. Med., 208:1027 (May 18) 1933.

fection in a joint, even those cleared up, disturbs its normal function, and therefore makes it particularly susceptible to the wear and tear of life. Indeed, osteoarthritic symptoms may supervene months or years later in joints spectacularly cured by the removal of the focus of infection. Thus, it is evident that rheumatoid arthritis may be an important predisposing factor in the production of osteoarthritis.

What other factors seem important in this type of arthritis? One of the most important changes occurring at the time of life when osteoarthritis appears is noted in the blood vessels. The larger and smaller arteries show arteriosclerosis, thickening of their walls, gradual diminution of their lumens and loss of elasticity. This leads to a gradual reduction in the blood supply to the joints. That changes also occur in the capillary bed about joints can also be inferred from a study of the peripheral capillaries. Thus, on direct examination, it is evident that, in a large number of arthritics, the capillaries in the fingernails become fewer and more tortuous. Further evidence of a decrease in the vascular supply to the joints is obtained by studying the surface temperature, which, in a large number of osteoarthritic patients, is definitely lowered. Whether these vascular changes are part of the arthritic syndrome or factors in its production matters little. Certainly, their association points to the degenerative nature of osteoarthritis.

Endocrine imbalance, particularly of the thyroid and ovaries, is found in osteoarthritis so frequently as to be worthy of consideration. A lowered basal metabolism, with its attendant symptoms of thyroid hypofunction, occurs in a noticeably large number of these patients. Again, at the time of the menopause, with its glandular disturbances and the tendency to gain weight, osteoarthritic symptoms often appear, speaking for an acceleration of the degenerative processes in the joints. So marked is the association of osteoarthritis and the menopause that some workers speak of a menopausal arthritis.

Heredity is a factor in a large number of patients. Many instances of osteoarthritis appear in one family. How can inheritance of this chronic degenerative condition be explained? Certainly, patients do not inherit osteoarthritis in the sense that they are born with it. Rather, they inherit tissues that are susceptible to degenerative changes. They lack a certain, as yet poorly understood, tissue resistance, which makes them victims later on in life of arthritis, arteriosclerosis and other signs of senile degeneracy.

Foci of infection in osteoarthritis play a minor, if indeed any direct, rôle. Previous mention was made of the possibilities of osteoarthritis developing in a joint formerly injured by infection, even though the infection had been completely eradicated. Nevertheless, foci of infection, by disturbing the delicately balanced metabolic processes of the body through its toxins, may prepare the soil for earlier and more severe degenerative changes throughout the body, the joints included. Bacteriologic studies of the blood, joint fluid and tissues, as well as blood serum agglutination tests for bacteria, are universally negative. Clinically, there does not appear to be any close relationship between foci of infection and osteoarthritis.

Osteoarthritis rarely manifests itself clinically until middle life, at which time it is seen particularly in overweight persons who give a history of moderately hard labor. It affects the knees, spine, hands and hips. The onset is insidious, the discomfort less marked than in the rheumatoid type. The terminal joints of the fingers may present irregular nodular

swellings, before pain is a symptom. Not infrequently, only one joint is complained of, although roentgenologically several are found to be affected. Ankylosis never occurs in uncomplicated osteoarthritis.

Rheumatoid arthritis has, since the time of Frank Billings,[2] been associated with foci of infection. At times, it seems definitely settled that rheumatoid arthritis is infectious in origin; again, its infectious etiology is doubted; and again, it is practically denied. In other words, the camp of arthritis workers is divided into three groups: the believers, the doubters and those who flatly deny its infectious etiology. Of these three groups, the doubters predominate, and will close their arguments with some such statement as "The infectious etiology of rheumatoid arthritis has not yet been satisfactorily proved." Nevertheless, a great deal of evidence which makes the infectious theory quite attractive has been accumulated by various men. Billings,[2] Davis and Rosenau, twenty years ago, called attention to the importance of focal infection and arthritis, at the same time pointing out that there must be some other factor, or how else could the frequency of focal infection as compared to arthritis be explained? They suggested a temporary lowering of resistance along with a focus of infection. Among the modern exponents of the infectious theory are Cecil, Nicholls and Stainsby.[3] They believe that there is an actual bacterial invasion of the joints, the bacteria arising from some focal point. To substantiate their claims, they cite a great deal of bacteriologic work. Thus, they obtained positive blood cultures in 62.3 per cent of 154 patients having rheumatoid arthritis. Their cultures from the joint fluid of the same 154 patients were positive in 67.3 per cent of cases. The organism most frequently recovered was *Streptococcus hemolyticus*. Four strains were so frequently obtained that they were called the "typical strains of Cecil." Agglutination tests made by using the serum of rheumatoid arthritis patients and the typical strains were found by Cecil and his co-workers to be positive in about 90 per cent of cases. Dawson and Boots confirmed these agglutination tests, but found that rheumatoid arthritic serum would also agglutinate streptococci obtained from scarlet fever or erysipelas patients. They admitted that blood serum from cases of rheumatoid arthritis would agglutinate streptococci, but could find no specificity as to type or strain. An increase in the sedimentation rate of the red cells, a phenomenon indicative of active infection, is noted in active rheumatoid arthritis. In the more acute states, there is a moderate leukocytosis.

Pathologically, the condition in the joint compares favorably with the process seen in tuberculous and gonorrheal arthritis, both known to be bacterial in origin. The synovia is early invaded, with the formation of granulation tissue, which grows out over the cartilage, eroding and gradually destroying it. This granulation tissue is later replaced by fibrous tissue, fibrous adhesions resulting between the joint surfaces, and leading to a fibrous ankylosis. At times, bone is laid down in the scar, a bony ankylosis resulting. Atrophy of the subarticular bone, with slight marginal proliferation,

2. Billings, Frank; Coleman, G. H., and Hibbs, W. G.: Chronic Infectious Arthritis, J.A.M.A., 78:1097 (April 15) 1922. Billings, Frank: Chronic Focal Infections and Etiologic Relations to Arthritis and Nephritis, Arch. Int. Med., 9:484, 1912; Chronic Focal Infection as Factor in Chronic Arthritis, J.A.M.A., 61:819, 1913; Focal Infection, ibid., 63:899, 1914.

3. Cecil, R. L.; Nicholls, E. E., and Stainsby, W. J.: Etiology of Rheumatoid Arthritis, Am. J. M. Sc., 181:12 (Jan.) 1931.

also occurs. Of particular note in these joint tissues, and emphasized by Ghormly, are small local areas of round-cell proliferation.

Clinically, the disease resembles an infective process. It occurs most often in young adults. The onset may be acute or subacute with fever, backache and polyarthritis. The joints are reddened, swollen and tender. There is a tendency for the joint symptoms to be migratory. Furthermore, the onset often coincides with a flaring up of some obvious focus of infection, such as the tonsils or a periapical abscess.

While the points already cited in favor of the infectious theory appear quite convincing, they fail to solve all the problems, and the attempts to explain certain inconsistencies have lead to much theorizing. What are some of the problems? 1. Why do not more people develop arthritis who have known foci of infection? 2. Why is it so difficult to culture organisms from the joint tissues? 3. Why does not removal of the focus always produce a cure? 4. Why do foci of infection, particularly apical foci, become aggravated and new ones appear in the course of an arthritis? 5. Why can a patient harbor a focus of infection for indefinite periods and then suddenly develop rheumatoid arthritis?

In order to explain these inconsistencies, it becomes necessary to assume that the patient having rheumatoid arthritis is in some way different from the nonarthritic person. Heredity has not been particularly kind to him. His tissues have a certain susceptibility to toxins, bacteria and trauma, either emotional or mechanical. There is a lack of inherent tissue resistance. If this is true, does the patient having rheumatoid arthritis manifest any such signs? He most certainly does. First, look into his tissue inheritance, and there will often be found a family history of arthritis. Even anthropometric studies indicate a susceptible type, the slender, long bodied, enteroptotic person. Study of these patients from the standpoint of their emotions reveals them as often neurotic and emotional. Look at their vasomotor or vegetative nervous system: What does it reveal? Certainly, in many patients, there is a marked vasomotor instability, cold, clammy, cyanotic hands and unstable pulse and blood pressure. Examination of the endocrine system reveals an unusual number of thyroid and ovarian disturbances. Even the capillaries seem not to be normal. As seen by direct vision, they are less numerous, and the surface temperature of the body is often lower than normal. The gastrointestinal tract presents such stigmas as ptosis, irritability of the colon and constipation, with a resulting faulty absorption. Metabolism also deviates from the normal, as Pemberton has shown, particularly as regards sugar, and, as recent workers have suggested, as regards sulfur.

But of what value is it to study the arthritic patient so minutely, to reveal his inherent weaknesses and lack of tissue resistance? Its value lies in the fact that, by so doing, there has been revealed an area on which the focus of infection may act. It explains why so many can harbor foci of infection with seemingly no harm. It explains, at least in part, why some have a severe arthritis and minor focal infection, while others with extensive focal lesions have only vague rheumatoid distress. It helps to explain how one can harbor a focus of infection for a long time, and then, because of an unusual mental shock, debilitating disease, unusual exposure to cold or wet or undue fatigue develop a rheumatoid arthritis. In other words, without destroying the idea of a focus of infection, this concept removes some of the burden

from its shoulders. It intimates that a focus of infection may find fertile soil at once, or may slowly so reduce the resistance of the tissues that rheumatoid arthritis develops. Furthermore, by using this concept, one need not adhere too closely to the bacterial invasion of joints. It is possible to explain the condition equally well by the action of toxins or protein products derived from a focus of infection.

Still another possible explanation for rheumatoid arthritis has been suggested by Zinsser and numerous allergists. These men believe that the joints become sensitized to the bacteria or bacterial proteins in the focus, and finally these hypersensitive tissues react in a typical allergic manner to subsequent exposure. The allergic explanation answers some of the problems; but the pathologic process in a known allergic joint clears up, leaving no residual findings comparable to those seen in rheumatoid arthritis.

Burnett,[4] of Boston, has suggested that arthritis might result from disturbances in metabolism, particularly the anabolic phase. This disturbance he traces to altered function of the bowel, particularly increased motility, which can obviously interfere with normal absorption, allowing many essential elements to escape absorption; or there may be a selective failure of absorption. Dietary deficiency might also produce anabolic changes. These ideas have also been reflected in some of the vitamin deficiency theories of arthritis.

Thus, it becomes evident that osteoarthritis and rheumatoid arthritis occur in persons whose heredity as regards the body tissues is poor and who show definite stigmas of physical inferiority. Add to this constitutional make-up repeated trauma, and osteoarthritis will develop. Add to it infection, and rheumatoid arthritis appears. Since many will be subjected to both trauma and infection, there will be many cases of mixed arthritis. Roentgenologists report multiple joint lesions, some of one type and some of the other. Both types may occur in one joint.

Of what interest is all this to the dentist? Only by understanding the etiology of these forms of arthritis, by appreciating their similarities and differences can one develop a rational therapy. Realization of the complexities of the etiology of arthritis brings out a glaring fault in the usual management. In the haste to treat the joints, is not the patient being neglected? More effort must be made to study patients, to learn their heredity and, if possible, their tissue pattern, so that sometime it may be possible to foretell how a focus of infection or repeated trauma is likely to affect them.

Since focal infection as it applies to the teeth concerns you the most, it shall be considered. Focal infection is of great importance in rheumatoid arthritis, and of minor importance in osteoarthritis. Therefore, the dentist should make an effort to determine which type of arthritis he is dealing with. It will be only in the rheumatoid type that you can expect spectacular results, and then only in a small proportion of cases. Your greatest field is in prophylactic treatment, because, by prevention and early removal of these foci, many patients may be spared arthritis. The prophylactic measures that would seem to offer some hope are: (1) frequent periodic examination of the teeth, including vitality tests; (2) due consideration of the fact that, in the devitalizing of a tooth, a possible focus of infection is being created; (3) frequent clinical and roentgenologic examination of all devitalized teeth; (4) im-

4. Burnett, F. L. and Ober, F. R.: Arthritis, Anabolic Nutrition and Health, Am. J. M. Sc., 188:93 (July) 1934.

mediate extraction of all teeth suggesting apical granulomas on roentgenologic examination, even though giving no trouble; (5) avoidance of formation or persistence of pus pockets about the gingival margin; (6) instruction to patients to submit to a clinical and roentgenologic examination of the teeth after recovery from any serious debilitating disease, since there appears to be a relationship between debility and apical granuloma; (7) insistance on frequent examination of the teeth in all pregnant women and continued examinations after childbirth.

In the treatment of rheumatoid arthritis, dental foci of infection should be eradicated. If the disease is acute, with redness, swelling and pain of the joints, the condition should subside before dental surgical measures are instituted. In a first attack of rheumatoid arthritis which has been present but a few months, good results may be expected, provided there are no other foci of infection present. These are the patients whose arthritis sometimes clears up almost immediately. If the patient is having an exacerbation of a chronic rheumatoid arthritis, statements as to the probable benefit to be derived should be guarded. There may be noticeable relief, or none at all. In chronic arthritis, it is difficult to say whether a dental granuloma bears a causal relationship to or is an expression of the systematic manifestations of the disease. That apical granuloma and caries do develop, often very rapidly, as a part of chronic arthritis and other debilitating diseases, has been definitely shown by Pemberton. Undoubtedly, this is another manifestation of the lack of tissue resistance that these patients present. In debilitated chronic arthritics, the removal of dental foci requires very careful judgment. The shock incident to the extraction may aggravate the arthritis, even though only one tooth, or at most two teeth, are removed. Again, to render these patients partially or totally edentulous may so interfere with their nutrition as to unfavorably affect the disease. The common belief that an aggravation of joint symptoms following the removal of a focus of infection is indicative of a causal relationship has little to support it.

Focal infection, in its relation to osteoarthritis, presents another problem. Here, there is little evidence of any direct causal relationship. Little can be hoped for in the way of spectacular results, and nothing can be hoped for as regards cure. There is but one indication for the removal of foci of infection in osteoarthritis. If there is reasonable evidence that the infected focus is affecting the general health of the patient, it should be eradicated. Obviously, anything impairing health and increasing debility will be reflected in the joints. Remember that these patients are in the upper age bracket and that their arthritis is only one manifestation of degenerative disease. They probably also have arteriosclerosis, myocardial degeneration and metabolic and endocrine disturbances. To render a patient toothless in the presence of severe degenerative disease may do him distinct harm, and certainly no great good.

Keep always in mind the fact that you are treating a patient, and not arthritis. Eliminating a focus of infection is only one step toward bringing an arthritic patient back to a reasonably normal life. The value of your work may be entirely lost by failure to employ intelligently all worth while therapeutic measures. Accept your responsibility as regards the teeth, but remember that the best results can be hoped for only when dentists and physicians cooperate to the fullest extent.

WHAT ONE MAY SEE IN A CHILD'S MOUTH*

By WALTER C. McBRIDE, D.D.S., F.A.C.D., Detroit, Mich.

ANY ONE but a research worker is treading on very thin ice when he attempts to admonish a parent on the very debatable subject of just what will lessen the incidence of caries. Hygiene and the dietary, all agree, are particularly important, and yet for children and adults not in institutions, these factors are apparently uncontrollable, and caries continues.

There are a number of important factors in diagnosis and treatment that tend to assure normal facial development, the principal one, of course, being the retention of the deciduous teeth until normal exfoliation. In considering early recognition of the abnormal, and following the premise that a picture is worth a thousand words, the roentgen rays become a very important adjunct in diagnosis and early treatment.

It is not my intention to suggest when roentgenograms should be taken or how they should be taken, but only to intimate the reasons for securing roentgen-ray pictures of children's teeth, on stated occasions, and to present what one may find or see by so doing. Neither do I wish to suggest whether full-mouth films should be made as a routine periodically or only an occasional roentgenogram. Many believe it good policy to take full-mouth films of children yearly or at stated intervals; while, generally, the occasional film taken to answer a specific question suffices.

The roentgenogram has two distinct values: (1) it imparts information to the operator and (2) it enables him to more clearly and concisely depict to the patient or the parent the conditions present. In other words, it enables him to be informed and to act informed. Which of these two is the more important factor in building and maintaining a practice, I am not prepared to say, but I am imbued with the idea that the latter impresses the stable, referred patient as well as the nomadic type.

The matter of acting informed is no more nor less than an ability to present a subject verbally and graphically, the latter of which is perhaps the more effective and might be classified as visual education. Parents are grossly uninformed as to the conditions existent in their children's mouths, of the changes that occur, of growth and development, of the reasons for exfoliation of the first dentition and eruption of the second, of frequent abnormal placement of teeth, of fusions and impactions, of congenital absence of teeth, of the presence of supernumerary teeth and, finally, of the complications that arise from caries and infection, and the consequent extraction of teeth.

Visual education, the few minutes spent at the chair with a parent, presenting the story of the why and wherefore of the child's condition, both with models and with roentgenograms, has possibilities as great as the esthetics and dura-

*Read before the Section on Children's Dentistry, Preventive Dentistry and Mouth Hygiene at the Seventy-Second Annual Midwinter Clinic of the Chicago Dental Society, Feb. 19, 1936.

bility of your technical service. Again, if a picture is equal to a thousand words, as is manifested and conceded by writers and publishers, the roentgenogram should play an important rôle in children's dentistry. I mention children's dentistry in particular because of the many interesting things one may see and portray. A series of pictures of a given child's mouth over a period of years presents to a parent a very lucid story of growth and development; while a series of pictures of an adult mouth over a similar number of years would present to the same laymen a very regular similarity.

THE NORMAL

Now, what does one see in a child's mouth? First of all, it is interesting and instructive, from a comparative viewpoint, to view the normal. I think I have made some very tangible impressions with parents by taking time here and there to present the normal in mouth development. Lay people seem exceedingly grateful, and respectful, when portrayal is made of the phenomena occurring in their child's mouth.

I thoroughly enjoy the spontaneous reaction, verbal and physical, when I present a series of roentgenograms and say to the parent:

Here is a picture of normal development in a child of 4. Note the presence of the baby molars, their size, length of the root and the pulp or vital portion, the part that you call the nerve, and the developing buds of the succeeding teeth that will erupt between 10 and 11 years of age, when these "baby teeth" are lost. This is the partly developed crown of the first permanent molar, which grows and comes into place behind the "baby" molars at 6 years of age. It does not replace any tooth. It is the first of the second set. It comes into apposition with a similar tooth in the arch above and thus holds the jaws apart while the "baby teeth" are being shed and replaced.

This picture is of a child of 5. See how the first permanent molar is developing and slowly coming into position. And here is a child of 6, with the permanent molar in normal alinement and occlusion, ready for function and a lifetime of service.

Here, in a child of 8, one can observe the buds of the succeeding teeth further developed and growing well up toward the roots of the temporary teeth. Here, at 8½, the pressure exerted at the root-ends by the erupting tooth has stimulated an obscure bodily function, and the roots of the "baby" molars are resorbed, or torn down and removed. At 9½, there is more evidence of this activity and, at 10, the roots and the enveloping bone tissue have been entirely removed, the remaining crown portion being held in place only by gum tissue attachment and thus being about to be lost. Immediately thereafter, this tooth, the bicuspid, comes into place and function.

This is an old story to dentists; but perhaps the narration and the depiction of such old stories to us, to new and bewildered parents, is that intangible something which makes patients respectful of one's ability and constant through the years.

MISSING TEETH

Perhaps among the anomalies common to teeth, the missing tooth is the most prevalent. In my own office, I have seen a child of 8 showing an absence of twenty-six permanent teeth, and a child of 12 with twenty-two permanent teeth missing; that is, the roentgenogram revealed the absence of the teeth or tooth-buds. A Dr. Samuels reports a case of twenty-eight absent teeth, only the first permanent molars being present. Boyd Gardner reports a case in which there was an absence of twenty-three teeth. Pitts reports the lower central incisors absent in four members of one family, a very unusual occurrence, it seems. Ralph G. Bengston, of Chicago, reports, in a survey of 563 children of from 5 to 13

years, thirty-eight children with one or more congenitally absent teeth: eighteen lacking one; three, four, and two, five. Thus, 6.7 per cent have, according to his statistics, deviations from the normal.

Zifferblatt, in his remarks concerning the absence of teeth, says, "At no time in the history of this anomaly has there been a case report of the absence of the deciduous tooth preceding absence of the succedaneous tooth." I do not wish to appear to disprove his conclusions, but I have seen in one instance, which I will present later, the absence of the maxillary right lateral incisor in both the first and the second dentition.

By far the most commonly absent teeth are the maxillary lateral incisors. To account for this fact, Bromell states that the tooth sacs containing the lateral incisor follicles are found immediately beneath the palatal plates and frequently, during their earlier life, they are not even protected by the bone, being in immediate contact with the mucous membrane. On account of this imperfect protection, the germs are sometimes injured and the teeth fail to make their appearance.

To give a further reason, or another reason, for absence of the lateral incisors, Campbell, in discussing the relation of missing lateral teeth to hereditary syphilis, says:

> My own opinion, based on thirty years' observation of over 2,000 patients, is that the absence of the upper lateral incisors sometimes occurs in members of syphilitic families, and, conversely, might in some instances be an indication of hereditary syphilis. Missing lateral incisors, equally with Hutchinson's teeth, are a valuable but a delicate diagnostic sign.

In the presence of this anomaly, absence of the lateral incisors, the question arises: "Shall I let the cuspid drift, or have it moved mesially into the place of the lateral incisor? Or shall I hold the space, or have sufficient space created by orthodontic assistance, and insert a bridge, replacing the missing tooth?"

Family finances are a determining factor in such instances, and perhaps must be the predominating one. The dentist, if allowed to use his own judgment, can greatly facilitate diagnosis and the presentation of his conclusions to the parent by taking two more or less "snap" impressions in compound, and then, after pouring them, adjusting the cuspid teeth mesially or distally on the finished model.

I grant that general occlusion or malocclusion has much to do with the ultimate mesial or distal placement of the cuspids, but, for all general considerations, this is an excellent expedient to assist both the dentist and the parent in a final decision.

SUPERNUMERARY TEETH

Zifferblatt says, "It has been proved definitely that supernumerary teeth develop as a result of continued growth of unresorbed areas of the dental lamina in the interspaces between developing teeth."

Kronfeld writes:

> Supernumerary teeth may be observed in any part of the dental arch. In some instances, these teeth seem to be just small peg-shaped structures which are apparently the result of an atypical overactivity of the dental lamina. In other cases, it seems that their development might be some form of atavism. It must be kept in mind that the two incisors and two premolars of modern man are the result of a reduction from the three incisors and three premolars in each half of the jaw of the early ancestors of present-day mammals. Bolk called the peg-shaped supernumerary tooth that is found in the upper jaw in or near the median line "mesiodens." In some jaws one mesiodens is present, in others, two; they may remain impacted and be visible only in the radiograph, or they may erupt between or be-

hind the upper incisors. Their presence must be considered a true atavism, namely, a recurrence of the third incisor that has been eliminated early in the development of the human race.

In an experiment carried on several years ago, in the Indiana Hospital for the Insane and the Indiana School for the Feeble Minded, by Dr. Downs, of the University of Indiana faculty, for the purpose of determining whether certain types of dental anomalies occurred regularly in definite types of endocrine dyscrasia, a depraved body condition due to disease, it was found that about 50 per cent of all cases of endocrine dyscrasia showed dental anomalies, while only 17 per cent of the normal group showed this condition. Thus, while the condition was more common in endocrine cases, no conclusion of a positive nature could be drawn regarding its regularity. . . . From all detailed experimental studies, it is evident that, while the endocrines may play an important part in calcium metabolism, they do not apparently act in such a way as to cause regular dental anomalies.

Deciduous supernumerary teeth are quite uncommon, but, when found, are usually in the maxillary central or lateral region. If in the central region, they are likely to be conical and rudimentary, being placed between the normal central incisors, a diastema resulting; or they occur unerupted and inverted, lying directly between the roots of the central incisor. Stafne reports that of 200 supernumerary teeth in the region of the upper central incisors, 114 were inverted. If deciduous supernumeraries occur in the lateral region, they usually assume the natural size and shape of the lateral incisor and consequently are frequently overlooked until the exfoliation period.

Because their development occurs simultaneously with the formation of the normal teeth, supernumerary teeth very frequently are responsible for delay and noneruption of the permanent teeth.

Most of the complications for which supernumerary teeth are responsible can be avoided by early recognition of the presence of the supernumerary teeth and removal of these teeth at an early age, which may be a means of avoiding the majority of cases of delayed eruption or malposition of the permanent teeth.

FUSION OF THE TEETH

Fusion of the teeth evidently occurs through some irregularity in the tooth germs, a union of the germs occurring during the developmental process.

Fusion of the second teeth occurs usually in the upper incisor region or in the region of the second and third molars. Concrescence, i.e., fusion of the roots only, the crowns being distinct and separate, is most evident in the bicuspid region.

Fusion of the first teeth, according to my observations, usually occurs between the cuspid and the lateral incisor, and is most commonly present in the lower arch. All that I have encountered have been on the right side.

SUBMERGED MOLARS

The phenomenon of submerging of the molars, affecting most commonly the second deciduous molar, but very frequently involving the first deciduous molar as well, is a condition in which the affected teeth, which formerly have been in occlusion, have dropped away from the occlusal plane and apparently are sinking deeper and deeper into the gum and alveolar tissue.

While little has been written regarding the etiology of this anomaly, a few theories are available. Kronfeld assumes that it may be due to ankylosis. He says:

The resorption of the deciduous tooth is

not a continuous process, but a series of periods of activity and periods of rest. There are periods of great activity in which a larger portion of the root and alveolar bone is resorbed than the eruption of the permanent tooth would necessitate and, during the following period of rest, a new formation of bone is laid down in the area, forming a temporary junction between bone and tooth. At the next period of activity, this new formed bone is resorbed. This accounts for the periods of comparative firmness and period of looseness of deciduous teeth during the exfoliation time.

It is his contention that, in some instances, this temporary junction may become a permanent ankylosis, thus prohibiting exfoliation and the consequent eruption of the succeeding tooth. The occlusal growth of the adjacent teeth gives an apparent sinking-away effect of the ankylosed tooth.

Another writer says:

The crowns of the deciduous molar are shorter than the crowns of the two adjacent permanent teeth. To compensate for the difference in length, the deciduous tooth must continue to erupt slightly in order to reach the occlusal planes of the permanent teeth. If it fails to do so, it will be found wedged below the contact points of the approximating permanent teeth.

Another opinion seems to bear out the mechanics of the contact point theory. The forces governing the eruption of the first permanent molar are in the direction of the occlusal plane and forward. Naturally, then, as the permanent molar erupts past the point of greatest convexity of the deciduous molar—in other words, when the contact point of the permanent molar moves occlusally from the contact point of the deciduous molar—the tendency would be for it to move mesially. The forward pressure on the inclined plane would force the deciduous tooth apically, or downward, out of the line of occlusion.

It is difficult to decide which of these possibilities sounds the more reasonable. I can see the plausibility of each, but, at the same time, I can see, in each, questionable factors.

The solution for submersion of molar teeth is, in my observation, to extract the tooth, or teeth, at the time of normal exfoliation or shortly thereafter; i.e., sometime between the tenth and eleventh years.

RESORPTION OF ROOTS WITHOUT SUCCESSORS

The resorption of deciduous roots in the absence of the permanent successors is not particularly common, yet, in a children's practice, one encounters this condition quite frequently. It is a peculiar phenomenon and particularly difficult to define because of the divergent opinion of histologists and pathologists concerning resorption.

A great many authors are of the opinion that tooth resorption is promoted by the development and eruption of the permanent successor. Bromell believes that, at the opportune time, there appears at the apex of each deciduous root what might be called the resorptive organ, whose rôle it is to destroy the root and make way for the permanent tooth. Bunting is of the same opinion. Kronfeld agrees, but states that, in the event of root resorption without a successor, the biologic condition of the deciduous tooth itself seems to decide the outcome of the resorptive process. Tomes says, "Resorption is a vital act independent of the pressure exerted."

The idea of independent resorption seems to account for this peculiar condition, yet, if this were always true, one could not account for the great number of teeth retained in mouths for varying lengths of service.

Generally speaking, the retention of

the tooth, or its loss, appears to be dependent on the character or condition of the cementum. As long as the tooth has a vital cementum surface, it will be retained and will provide functional connection with the alveolar bone. Normally, then, as in teeth with successors, small areas of resorption will, in periods of inactivity, be restored with new cementum. The vitality of these teeth seems to be lost through senescence, whether it occurs in the twenties, thirties or later life; and when it does occur, areas of resorption are no longer restored and the resorptive process continues, by periods, until the tooth is lost. Though the loss of vitality and consequent loss of the tooth through resorption may be the rule, I have seen resorption occur in adolescence.

RETENTION OF TEETH; DELAYED EXFOLIATION

When teeth are retained beyond the normal exfoliation period, one can reasonably assume that either the patient has not developed normally or there is some abnormal condition present. In either instance, a roentgen-ray examination is indicated. It is particularly evident that there is a rather wide range between the physical and the chronologic age of the child. A child may be 12 years old, according to the calendar, yet may be only 10 years old in physical development. Another 12-year-old child may be 14 years old in physical development. Consequently, there is a wide range of possibilities as to whether a tooth should be extracted at a given age or maintained. Some children, slow in development, may normally retain deciduous central incisors until 8 or 8½ years, molars until 12 or 13 years and cuspids until 13 or 14 years. Others may lose the same teeth prematurely.

In a roentgen-ray examination, one may encounter impactions, malposition of teeth, odontomas, unerupted supernumeraries, congenital absence of teeth, or partly resorbed roots leaving retaining spicules.

Austin and Stafne, of Rochester, in a study of 150 retained deciduous teeth (that is, retained beyond the normal exfoliation period, in persons from 21 to 71 years of age), found eighty-one cuspids, with seventy-one in the maxillae and ten in the mandible; and sixty-nine deciduous molars, with thirteen in the maxillae and fifty-six in the mandible. Only two first deciduous molars were retained and both were in the maxillae. These authors gave as the reasons for the retention of the cuspids (1) congenital absence of lateral incisors; (2) congenital absence of the permanent cuspid; (3) malposition of the erupting permanent cuspid; (4) impaction of the permanent cuspid, and (5) the presence of odontomas. The reason given for the retention of the deciduous molars was the absence of bicuspids, in 98 per cent of cases.

I have seen many of these teeth give service for a very satisfactory period of time. A 72-year-old Michigan dentist has a first deciduous molar still giving good service. Seeing the tooth in place and the roentgenogram attests to this fact.

A patient of mine, now in her early twenties, is using very effectively a lower deciduous second molar. The only lament on my part is the fact that, about ten years ago, I removed a similar tooth on the opposite side of the mouth without taking a roentgenogram, only to learn later, with much chagrin, that there was no successor.

Lischer, of St. Louis, says:

> Retention of temporary teeth beyond the period of their need is acknowledged as a cause of malposition of permanent teeth, and clinical observations compel the conclusion that this occurs more frequently

when considerable wear of the occlusal surfaces is evident. But this wearing away of deciduous teeth is seldom due to vigorous mastication; most of it results from gritting the teeth during sleep. The latter is probably induced by dryness of the mouth associated with the mouth breathing of nasal obstruction.

Congenital absence of teeth is usually bilateral. While this is not always so, it is to be expected until found to be otherwise. Roentgen-ray examination, in delayed exfoliation or delayed eruption, is an exceedingly prudent diagnostic measure.

PROGRESS IN NUTRITION*

By JACOB E. KLEIN, M.D., Chicago, Ill.

THE science of nutrition is truly of vital significance to the human species. Given our protoplasmic heritage at birth, what we become physically and mentally thereafter depends to a great degree on what and how we eat. Owing to the labors of such men as Lavoisier, Rubner, Atwater, Benedict, Eijkman, Funk, Goldberger and their followers, we are now in position to guide our blind instincts with regard to food in the light of knowledge. More progress has been made in the past ten years in the field of nutrition than in all of the preceding history of the subject, because of revolutionary advances in biochemistry. By proper application of the principles of nutrition, we may increase the stature of human beings; render the thin person fatter, the fat person thinner; promote health, immunity and energy; lengthen the life span; cure certain deficiency diseases, and prescribe dietaries for various purposes, whether for growth during infancy and childhood, or for the great caloric needs of the physical laborer; or for the military needs of an army, or even for the special needs of a patient with a particular disease.

Our ideals and standards of nutrition have likewise progressed. Formerly, we emphasized the needs and constituents of an adequate dietary, which really signifies a minimum dietary, for maintenance. Now, the nutritionist emphasizes optimum diet as the desired goal. Any diet, to be suitable, must first satisfy the caloric needs and must furnish sufficient protein for repair and growth, sufficient carbohydrates and fats for fuel requirements, the important minerals and the very necessary vitamins.

It may be constructive to discuss these factors in detail in the light of modern experience. With regard to energy requirements, the average infant under 2 months requires from 45 to 55 calories per pound of body weight; over 2 months, from 30 to 45 calories per pound is sufficient. It has been estimated that an active boy of 14 years burns 5,000 calories a day. Contrast this with the 3,000 calories burned daily by a normal adult.

For repair and growth of tissues, proteins of high biologic quality are necessary. The biologic quality of a protein is determined by the nature of its amino-

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acid constituents. Among these, cysteine, lysine, tryptophan and tyrosine are the most important. Thomas[1] has demonstrated that proteins from animal foods are of higher biologic value than those from vegetable foods. He presents the following list: cow's milk, biologic value 100; ox meat, 104; fish, 95; crab meat, 79; peas, 56; wheat flour, 40; corn meal, 30. This table does not seem to be very encouraging to the vegetarians. It is quite apparent that different proteins have a different value in the body economy. A most interesting example is related by Howell[2] concerning gelatin as a food stuff. During the French Revolution, when there was a scarcity of food, a scientific commission recommended gelatin as a nutritious and most economical food since it could be readily manufactured from old bones, etc. It was largely used in the nourishment of hospital patients until the latter began to complain bitterly; whereupon, a second gelatin commission of the French Academy, in 1841, condemned it as useless and injurious. Now we know that gelatin is a poor protein food because it lacks some of these important amino-acids so essential for growth. Osborne and Mendel,[3] in a series of classic experiments, studied the nutritive values of the different proteins. They demonstrated that the leguminous proteins, when fed alone, are inadequate for growth. Some single proteins are quite suitable for growth. Among these are casein, gluten (from wheat), lactalbumin and vitellin (from eggs).

1. Lusk, Graham: Elements of the Science of Nutrition, Ed. 3, Philadelphia: W. B. Saunders Company, 1917, p. 371.

2. Howell, W. H.: A Textbook of Physiology for Medical Students and Physicians, Philadelphia: W. B. Saunders Company, 1919, p. 910.

3. Osborne, T. B., and Mendel, L. B.: Carnegie Institution of Washington Publication No. 156, Parts I & II, 1911.

The optimum protein intake is still a controversial matter. There are two schools of thought: those who advocate a high protein intake and those who favor a minimal protein consumption. It seems that people accustomed to a high protein intake are superior in physique and more energetic than those accustomed to a low intake. Orr and Gilks[4] report that the Masai tribe in East Africa, which lives on a diet composed of meat, milk and blood, is superior in physical development and energy to a neighboring tribe, the Akikuya, which is vegetarian in its dietary habits. Although it is possible to exist on a very low level of protein intake, it does not seem advisable for purposes of optimum nutrition in normal health to limit radically the protein intake. Sherman has suggested 1 gm. of protein daily per kilogram of body weight or about 70 gm. daily for the average man. Furthermore, it is desirable to have some of the proteins from animal sources because of their higher biologic quality. Ordinarily, the protein consumption varies according to local customs, as well as economic and social conditions. Investigators apparently believe that considerable variation in protein intake may be compatible with good health, depending entirely on the particular circumstances.

Carbohydrates and fats are primarily energy-producing foods. The carbohydrates spare the breaking down of the proteins and aid in the combustion of the fats. If the supply of fat is too high in the dietary, there is incomplete oxidation of the fats, with resulting ketosis; that is, accumulation of intermediate products of fat combustion, chiefly acetone and β-oxybutyric acid. This fact is used to advantage in the "ketogenic diet," which is

4. Orr, J. B., and Gilks, J. L.: Studies of Nutrition: Physique and Health of Two African Tribes, Medical Research Commission Special Report No. 155, 1931.

quite effective in the modern treatment of epilepsy. If severe physical work is to be done, for example, an athletic contest, it is advisable to have a generous carbohydrate allowance.

Recent studies indicate that some carbohydrates may even be injurious to the health. Mitchell[5] was able to produce bilateral cataracts in from twelve to thirty-seven days by feeding rats generous amounts of lactose or galactose. In view of the recent vogue of lactose sugars in infant feeding, these experiments may serve as a caution.

Mineral salts are essential to life. Disease due to various mineral deficiencies is being more thoroughly studied and understood. The most significant minerals, according to present knowledge, are calcium, phosphorus, iron, iodine, copper and manganese. Calcium is present in the body in greater amount than any of the other minerals. More than 99 per cent of the calcium is stored in the bones and teeth. Sherman has long contended that the American dietary is deficient in calcium intake, and suggests 1 gm. daily for children and 1.5 gm. for pregnant women as an optimum standard. Vitamin D is essential for the proper utilization of calcium by the body. Consequently, the calcium intake should be higher during the winter months when there is a minimum of vitamin D or sunshine.

In this connection, it may be of interest to consider the controversial subject of dental caries. A recent editorial[6] has stated very appropriately that "there are almost as many opinions on the causation and prevention of dental caries as there are workers on the subject." With the prevailing theories, enthusiasm and convictions on this subject in mind, it would seem safe to postulate that there is no single etiologic factor in dental caries. A theoretical biochemical equation for the formation of a healthy tooth might read as follows: good hereditary stock plus good prenatal conditions plus proper infant feeding plus normal hygienic conditions plus normal development during childhood, with a minimum of contagious diseases, plus normal endocrine function plus unknown factors equals a normal healthy tooth. Abnormality in one or several of these factors forms a biochemical equation that spells dental caries. What I desire to convey is the fact that dental caries is a symptom and not a disease. For this reason, I feel that no one will find *the* cause of caries, but various causes will be found under varied conditions in different geographic localities among different peoples.

Iodine is another element essential to normal function and health. It is chiefly concerned with the activity of the thyroid gland. Iodine deficiency has been determined to be the chief cause of goiter. It is not the only cause of this condition. Some personally conducted researches[7] have tended to demonstrate that there is a correlation of iodine and calcium in normal thyroid function. Calcium promotes the storage of colloid in the thyroid gland. An excess of calcium in the diet plus an excess of iodine, in my opinion, is the cause of the ordinary colloid goiter. An excess of calcium in the presence of iodine deficiency induces hyperplastic goiter. Overactivity of the sympathetic nervous system in the presence of iodine deficiency is, in my opinion, the cause of toxic goiter. This is a good example of the delicate correlation of various factors

5. Mitchell, H. S.: Cataract in Rats Fed on Galactose, Proc. Soc. Exper. Biol. & Med., 32: 971 (March) 1935.

6. Dental Caries, editorial, Am. J. Pub. Health, 9:972 (Sept.) 1934.

7. Klein, J. E.: Correlation of Mineral Metabolism and Vegetative Nervous System in Thyroid Disease, Ann. Int. Med., 8:798 (Jan.) 1935.

in maintaining the function of an organ. A similar principle may hold true in other fields of nutrition and body chemistry. There is normally a delicate equilibrium based on many factors, some of which we know, and many of which we do not know. A consciousness of the latter fact may prevent many errors, and is conducive to a certain sense of humility.

Vitamins are a subject of extraordinary general interest at present, owing to the revolutionary advances in biochemistry. Chemical formulas have been determined, purified vitamins have been prepared and substances that were once considered mysterious unknowns to be designated alphabetically are now familiarly known as definite chemicals that can be tested chemically and in some instances measured quantitatively. The extreme clinical reactions to vitamin deficiency that we designate as definite diseases, such as scurvy, beri-beri and pellagra, are comparatively rare. The latent nutritional deficiencies are more difficult to diagnose and are receiving the special attention of nutritionists.

Russell L. Haden,[8] in a very excellent discussion of nutritional deficiency diseases, states that, outside the laboratory, where pure deficiency disease may be produced regularly under controlled conditions, the clinical manifestations are usually multiple and of a mixed character. Certain symptoms and signs are known to indicate a specific nutritional defect. Thus, night blindness, xerophthalmia, and keratomalacia signify vitamin A deficiency. For this reason, vitamin A is sometimes called the anti-ophthalmic vitamin. Glossitis or atrophy of the tongue, associated with peripheral neuritis, indicates vitamin B deficiency. Dermatitis, stomatitis, skin pigmentation and photosensitiveness, associated with mental slowness, suggest a deficiency of vitamin G, the antipellagric vitamin. A tendency to hemorrhage, particularly about the gums, indicates vitamin C deficiency or scurvy. Some types of sterility, we now understand, are due to vitamin E deficiency. The serious type of anemia, designated as pernicious anemia, has been found to result from lack of an antipernicious anemia factor that occurs normally in the gastric tissues. Interest in the deficiency diseases is steadily growing with increasing knowledge and the realization that we are on the threshold of still greater discoveries. The physician who is not interested in nutrition will overlook some of these important diseases. The dentist, particularly, has an opportunity to make such diagnoses early, merely from the oral findings in some of these diseases.

Since the general public has become interested in the subject of vitamins, it is advisable to sound a note of caution by pointing out that these substances occur in very minute amounts in nature. The body requires only very small amounts of vitamins to meet its physiologic needs. Excessive zeal and overdosing with these potent chemicals, especially in the purified and concentrated forms now available, may be injurious.

The two most prevalent nutritional disturbances of children are malnutrition and rickets. Roberts[9] studied the dietary habits of 6,015 preschool children in Gary, Ind., and determined that 90 per cent of these children were receiving an inadequate diet; 57 per cent had no milk to drink; 59.5 per cent received no eggs; 60 per cent received no fruit, and 50 per cent consumed no vegetables except potatoes. Many received tea and coffee instead of milk. Owing to deplorable eco-

8. Haden, R. L.: Multiple Specific Nutritional Disease in the Adult, J.A.M.A., 106:261 (Jan. 25) 1936.

9. Roberts: U. S. Children's Bureau Bulletin No. 123, 1922.

nomic conditions, many school children are suffering from semistarvation. Even in poverty, a well-balanced dietary may be arranged. It is one of the duties of the nutritionist to draw up dietaries that are well balanced and at the same time are economical. School meals and nutrition classes have done much to correct malnutrition in school children.

Rickets is the most prevalent nutritional disturbance observed in growing children in the temperate zone. It is a chronic nutritional disease involving calcium and phosphorus metabolism. The absence of vitamin D, associated with inadequate calcium intake, favors development of the characteristic manifestations of rickets. To diagnose rickets in the presence of bowlegs and other such gross deformities is no credit to professional intelligence. The present ideal is to diagnose very early rickets or even latent rickets; and, better yet, to prevent it entirely by adequate calcium intake and sufficient vitamin D and sunlight. In a growing child, who is not thriving and has flabby muscles and anemia, roentgenray examination of the epiphyses and a blood calcium estimation may aid in establishing a diagnosis of latent rickets before there are gross clinical manifestations. As is well known, the deficiency diseases do not develop suddenly overnight like acute infections, but come on very gradually over a period of weeks and even months, from a defective dietary. With modern laboratory methods for testing the vitamin content of blood serum, and for estimating blood calcium, phosphorus, etc., the diagnosis is readily established during the period of latency. The administration of vitamin D in sufficient doses and adequate calcium intake are truly specific in their curative effect on rickets.

The prenatal period is most significant as concerns the development and nutrition of the child. For this reason, the maternity and child welfare services that supervise the diet of pregnant women are of extraordinary importance. Special attention should be devoted to insuring an adequate intake of calcium, iron and vitamin D.

CONCLUSION

The science of nutrition is world wide in influence and is of practical interest to all mankind. Revolutionary discoveries are being made regularly. New professions, even, have been created to carry out the principles discovered. I have reference to nutritionists and dietitians who specialize in this work and who are proving indispensable in hospitals, schools and state institutions. It is desirable that more publicity be given to the basic facts of nutrition in order to counteract the destructive influence of the food faddists, nature fakirs and quacks of all sorts who are always with us.

NERVES IN THE DENTIN: A SURVEY OF RECENT LITERATURE ON DENTIN INNERVATION

By RUDOLF KRONFELD, B.S., D.D.S., M.D., Chicago, Ill.

THE recent announcement of a new desensitizing medium for dentin has again focussed the attention of the profession on an old problem; namely, the question of pain transmission through the human dentin.

For nearly a century, histologists have worked on this problem. Dependorf, Fritsch, Morgenstern, Mummery and Römer reported the presence of nerves in the dentin and in the dentinal tubules, and von Ebner, Gysi, Hopewell-Smith and Walkhoff denied their presence; to mention some of the most quoted investigators. The diversity of opinion is perhaps best expressed by two quotations: Türkheim, in 1918, wrote, with reference to the demonstration of nerves in the dentin by Dependorf and Fritsch, "The histologic foundations for the sensitiveness of the dentin are definitely established." Walkhoff stated, in 1922, "I consider all findings of those authors who described nerve fibers, to be deceptions."

Thus, it is obvious that anybody writing on dentin innervation can easily select from the hundreds of publications on this subject quotations or statements that will support his own point of view regarding the question.

In the introduction to his paper read before the First and Second District Dental Societies of the State of New York, Jan. 21, 1936, and before the Chicago Dental Society, Jan. 27, 1936,[1] Hartman cites a number of statements that are likely to leave with those not familiar with the literature on this subject the impression that there are no nerves in the dentin. He then proceeds to describe his own theory of dentin sensitivity and his method of overcoming it.

I wish to make it clear that I do not intend to discuss the clinical value of Hartman's method nor the scientific value of the quotations given by him. I merely wish to inform the profession regarding the great deal of scientific work on dentin innervation that has been carried out during the past ten years. Such information is the more important since this work begins at just about the time when Hartman's quotations from the literature end. I believe that, in citing quotations on any subject, the new developments in that particular field should be given prime consideration. Science is progressive, and many things that were the latest findings in 1905 (Hartman's quotation of Gysi) have only historical value now.

Among others, the following investigators have, during the past ten years, found and illustrated nerves in the dentin: Toyoda and Dieck, Münch, Riegele and Berkelbach.

Toyoda began his work in 1921, when he undertook a study of dentin innervation at the Dental Institute of the University of Berlin under the direction of the late Wilhelm Dieck. Toyoda applied a special technic of electro-osmosis to the decalcified dentin specimens. With this technic, of which a detailed description is

1. Bull. Chicago D. Soc., 16:4 (Jan. 30) 1936, D. Digest, 42:42 (Feb.) 1936.

given in his publications, he was able to remove all traces of free acid from the dentin and, thereafter, to obtain clearer preparations and better differentiation of the structures than his predecessors. After Toyoda's return to Japan, in 1926, Dieck demonstrated his technic and preparations. I was present when Dieck showed this material in Nuremberg in the fall of 1927, and the clearness of Toyoda's preparations was obvious. Dieck reported Toyoda's work in the German dental literature.[2] Little attention was then paid to this work outside Germany. The only account of it in English was a short report in the *British Dental Journal*.[3]

Recently (1933, 1934), Toyoda[4] has published additional photographs of nerves in the dentin in the German and Japanese dental literature. In describing his staining technic (Bielschowsky's block staining and Kimura's modification of Cajal's method), he calls special attention to the possibility of avoiding confusion between nerve fibrils and connective tissue fibrils in the dentin. Toyoda arrives at the following conclusions: Nerve fibrils can be demonstrated both in the dentin matrix proper and in the dentinal tubules. Within the tubules, the nerve fibrils accompany Tomes's fibers. Along their course in the tubules, the nerve fibrils give off still finer branches, which embrace Tomes's fibers. These intratubular nerve fibrils terminate in the peripheral layers of the dentin in definite nerve endings. In addition to these intratubular nerve fibrils, similar structures are found in the dentin matrix proper, running from one tubule to adjacent ones. Sometimes, a nerve fibril runs for a distance in a tubule, then passes through the matrix into another tubule, again follows the course of the latter for a distance, and so on. Frequently, the nerve fibrils show dichotomous branching.

Münch, of Würzburg, Germany, in 1927, illustrated nerve fibrils in the dentinal tubules,[5] and, in 1934 and 1935, reported further studies on the problem of dentin innervation.[6] He used an osmium-tannin staining method. His photomicrographs show the intratubular nerve fibrils and, very clearly, the nerve fibrils running in the dentin matrix proper. Münch's conclusions are generally in agreement with Toyoda's:

> The nerve fibrils in the dentin are derived from Raschkow's plexus in the pulp. In good preparations, they can be followed from the pulp into and through the dentin. The nerve fibrils are found in the dentinal tubules as well as in the dentinal matrix. The intratubular nerves frequently send off lateral branches of different lengths which can be followed past several tubules into the dentin matrix.

2. Dieck, Wilhelm: Ueber die alte Streitfrage der Existenz oder Nichtexistenz von Nervenfasern im menschlichen Zahnbein und ihre positive Lösung (Old Argument Concerning Existence or Nonexistence of Nerve Fibers in Human Dentin and Its Positive Solution), Korr. f. Zahnärzte, 51:138, 1927.

3. Dr. Toyoda on "Nerves in the Dentine," abstr. Brit. D. J., 48:1325 (Nov. 1) 1927.

4. Toyoda, Minoru: Die Innervation des menschlichen Zahnbeins (Innervation of Human Dentin), Tr. Nippon D. A., December, 1933; abstr. Deutsche Zahnärztl. Wchnschr., 37:641 (July 13) 1934.

5. Münch, Josef: Untersuchungen über die Innervierung der menschlichen Zahnpulpa und des Dentins (Investigations of Innervation of Human Dental Pulp and Dentin), Vierteljahrsschr. f. Zahnheilk., 43:503, 1927.

6. Münch, Josef: Sinnes physiologische und histologische Untersuchungsresultate zur Frage der Innervierung menschlicher Zähne (Results of Histologic and Physiologic Investigations on Innervation of Human Teeth), Deutsche Zahn-, Mund- u. Kieferheilk., 1:50 (Aug.) 1934; Die feinere Nervenversorgung der Zähne des Menschen (Nerve Supply of Human Teeth), ibid., 2:735 (Dec.) 1935; Ueber den Nachweis von Nervenfasern im Zahnbein des Menschen (Demonstration of Nerve Fibrils in Human Dentin), Deutsche Zahnarztl. Wchnschr., 38:671 (July 19) 1935.

In 1934, Riegele, of Berlin, using the Bielschowsky method, demonstrated the relationship of the nerve plexus between the odontoblasts and the nerve fibrils in the dentin.[7] He considers it particularly important to establish this connection, because, otherwise, it may not be possible to identify certain delicate fibrillar structures in the dentin as nerve fibrils.

The latest and most comprehensive study of the neurology of the teeth is the work of Berkelbach van der Sprenkel from the University of Utrecht, Holland.[8] His extensive publication, which includes, besides his own findings, a critical discussion of about 200 papers on subjects having a definite bearing on the problem, should be the starting point for anybody seriously interested in dentin innervation. For his own studies, Berkelbach used the teeth of man and the calf, cat, rabbit and other animals. He used a silver staining method modified from Gros's and de Castro's methods. With these methods, Berkelbach could follow nerve fibers from the pulp through the odontoblastic layer and into the dentinal tubules. In the dentin, the nerve fibrils end in very delicate terminal rings.

In January, 1936, Berkelbach's work appeared in English literature; unfortunately, in a greatly abbreviated form.[9] I quote the first paragraph of his summary, the other parts of the summary dealing with the nerves in the pulp and the periodontal membrane:

> From sections of human and mammalian teeth, prepared according to methods of Bielschowsky, de Castro and Gros, it is demonstrated that pulp nerves, having formed a network between the odontoblasts, enter the dentine. In the dentine they take an intratubular course, situated on, or more probably embedded in, the fibers of Tomes, where they end in delicate rings (Plate I, Figs. 1 and 2). It is believed that all the myelinated pulp nerves terminate in the above-mentioned intradental endings. The odontoblasts are not "innervated," and are not to be regarded as sensory cells.

This brief review of the recent work on dentin innervation is by no means complete. Additional studies have been reported in England (Stewart), Italy (Perna), Spain (Calderon) and Germany (Adrion), to mention a few. References to their work can be found in Berkelbach[7] and should be studied carefully by any one intending to undertake a study of this problem.

The demonstration of the presence or absence of nerves in the dentin is one of the most difficult problems of histologic technic. Careful selection of material, proper tissue fixation, special methods of decalcification and staining and great experience in the interpretation of minute histologic structures are essential. Many histologists have attempted to find nerves in the dentin and have failed. I should like to translate Berkelbach's statement on the value of negative findings: "In histology, one positive finding is worth more than 100 negative findings, and one unquestionably positive finding overthrows hundreds of perfectly logical arguments that something or other cannot possibly exist."

7. Riegele, L: Beitrag zur Kenntnis der Innervation des menschlichen Dentins (Contribution to Knowledge of Innervation of Human Dentin), Ztschr. f. Zellforsch. u. mikr. Anat., 20:432, 1934.

8. Berkelbach van der Sprenkel, H.: Zur Neurologie des Zahnes (Neurology of Tooth), Ztschr. f. mikr. anat. Forsch., 38:1, 1935.

9. Berkelbach van der Sprenkel, H.: Microscopic Investigation of Innervation of Tooth and Its Surroundings, J. Anat., 70:233 (Jan.) 1936.

THE RÔLE OF DENTISTRY IN THE CONTROL OF CANCER*

By FERDINAND C. HELWIG, A.B., M.D., F.A.C.P., Kansas City, Mo.

THE American Society for the Control of Cancer has placed the responsibility for early recognition of intra-oral cancer squarely on the shoulders of the dental profession and the dental profession has recognized and accepted this obligation, partly, perhaps, because of a certain lassitude on the part of the medical profession, it being a fact that more early malignancy is recognized in the oral region by the dental profession than by the medical profession. It is hard to believe that the oral cavity, which can be so easily examined by inspection, palpation and the use of the roentgenogram, has been neglected a great deal more by the medical than by the dental profession.

That cancer presents an enormous problem can be appreciated when we realize that more than 100,000 people die every year in the United States from all types of malignant disease. A fairly large number of these die from cancer of the mouth. Moreover, in a considerably larger percentage of all cases, death occurs from lesions primarily originating in the face, mouth and jaws. One of the most encouraging developments in the control of malignant disease is the increasing interest and enthusiastic activity of the dental profession in this field, this spontaneous and entirely voluntary cooperation being a godsend to thousands of potential sufferers from cancer. Your interest and enthusiasm has been only the natural result of the scientific achievement which has now, more than ever before, become a characteristic of modern dentistry.

The position held by the dental profession in regard to cancer control has been and is quite unique. You are all scientifically trained observers who have learned to recognize the early manifestations of intra-oral malignancy. You are frequently not only the first to note intra-oral cancer, but likewise the first to observe accurately and scientifically the early manifestations of cancer not specifically within your field; namely, cancer of the lip, esophagus and skin of the face and hands.

Moreover, your position is unusual in that it is possible for you to render an authoritative opinion of definite scientific value to a patient with an early suspicious lesion without arousing an untoward emotional reaction in the patient and thus possibly create "cancerphobia." These patients take your advice seriously. In addition to this, your opportunities to follow up early cases of this character are even better than those of the average medical practitioner and, as a result, it is possible for you to advise subsequent visits to your office in order to watch the progress of early questionable lesions and, if the signs are sufficiently characteristic, you are again in the unique situation that you can act as a totally unbiased scientific advisor.

*Address at a banquet of the 1936 graduating class of the Kansas City-Western Dental College, June 3, 1936.

It is entirely within your province to give accurate scientific advice and thus keep your patient out of the hands of charlatans and quacks. You can state authoritatively that roentgen rays, radium or surgical measures, or a combination of these three, are the only means by which cancer can be controlled or cured. You can advise of the necessity for immediate biopsy and the dangers of delay and, above all, your opinion will be thoroughly respected because your scientific advice is not tinctured with the thought of professional gain.

Of even greater importance is the rôle the dental profession plays in the prevention of cancer. Too long has the vision of the nose and throat specialist been confined to the region posterior to the anterior palatoglossal fold. Too long has the general practitioner examined the tongue only to observe the cyanosis of heart failure or the furring and cracking of dehydration. And too long had the attention of the dentist been too specifically confined to the abnormalities of the teeth. Modern medicine and modern dentistry have progressed beyond this state. For years, neither the dentist nor the practitioner of medicine paid close attention to such so-called minor lesions as leukoplakia, small ulcers, papillomas and syphilis, and these lesions were not seriously considered as the background of oral cancer. Teeth were extracted, alveolar abscesses opened, areas of tumefaction of the alveolar margin were incised or neglected, and lack of curiosity and training kept both professions in ignorance of the possibilities of these conditions as regards cancer. Moreover, many of these conditions were already full blown cancers which remained unrecognized.

The dentist and the physician now realize that oral hygiene does not consist in a twice daily use of the toothbrush. This subject takes in such widely divergent fields as the control of diet and examination of the blood in the presence of stomatitis, all of which demand periodic visits to the dentist's office for thorough oral examination and check-up, because, after all, the capital factor in cancer prevention is correct oral hygiene in all that the term implies. It has long been known that the cause of cancer is chronic irritation, which means poor oral hygiene. Recently, Solomon has outlined a few of the conditions that may lead to cancer somewhat as follows: Unfilled carious teeth with sharp edges cause chronic traumatism. Failure to have teeth replaced with the proper artificial substitutes often produces chronic irritation. The presence of irritating woody fibers embedded in the edentulous spaces of unfilled teeth may result in chronic irritation. Improper masticatory function, with the result that the teeth are allowed to tip improperly, often causes chronic irritation. Loss of molars may result in inability to prevent seepage of saliva at the corners of the mouth, which can produce fissures that may develop into epithelioma. Chronic mouth infections, if not carefully handled and corrected, may result in chronic irritation, and eventually epithelioma may supervene. Faulty dental restorations, with subsequent atrophy of the gums and resulting poor occlusion, may produce chronic irritation. Daily use of astringent mouth washes and the continued use of such escarotics as silver nitrate tend to promote abnormal growth of mucosa. "Touching up" benign lesions with lunar caustic is found, in past history, as a background of only too many well-developed epitheliomas.

These are but a few of the points to be taken into consideration when we talk about the prevention of cancer. It is only necessary to remember that probably 80 per cent of all cancer of the oral mucosa, exclusive of the lip, when such malignant

neoplasms are firmly established, have a hopeless prognosis. Therefore, our problem is not so much the recognition of established malignancy, but rather the recognition and the eradication of those lesions that are the forerunners of malignancy. Hence, every lesion that is suspicious should be submitted to biopsy. Frequently, excision of tissue for biopsy will result in cure. This is true of such benign lesions as the wart, fibroma, ulcerated hemangioma and the early ulcerated areas of leukoplakia. You may have been warned that the taking of tissue for a biopsy is dangerous in that it may result in severe hemorrhage, or that cancer cells may be disseminated to adjacent lymphatics. I have never seen a severe hemorrhage when tissue was taken for biopsy, and it is the firm opinion of all pathologists and most surgeons that excising of tissue for biopsy, particularly when confined to cancer of the face, mouth and jaw, is absolutely harmless.

The medical profession has more or less left to the dental profession the responsibility for early recognition of established malignancy and the prevention and eradication of precancerous lesions in the oral cavity. Hence, you, who are well-trained, scientific observers, are and will continue to be, the most important group in the prevention of incipient malignancy and the early recognition of established malignancy in your most important field.

IMPACTED TEETH IN SYMPHYSIS OF MANDIBLE: REPORT OF CASE

By JOHN H. NESSON, D.D.S., Boston, Mass.

A MAN, aged 35, was referred by his physician, Sept. 19, 1927, because of a Class 3 protrusion. The patient complained of tenderness and neuralgia of the mandible. Intra-oral roentgenograms had failed to reveal anything of note, but a lateral film disclosed the presence of a cuspid and a lateral incisor in the mandibular symphysis.

The teeth were removed at the hospital under ether anesthesia without difficulty, elevators being employed after removal of the overlying labial plate.

Recovery was uneventful, with complete disappearance of symptoms.

120 Boylston Street.

Cuspid and lateral incisor in symphysis of mandible.

The Journal of the American Dental Association

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C. N. JOHNSON, Editor

Published by the American Dental Association

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Editorials

THE SAN FRANCISCO MEETING

The 1936 meeting of the American Dental Association, July 13-17, brought to San Francisco a much larger attendance than had been anticipated. The latest figures are 8,000.

The necessity that takes our annual meetings to different sections of the country has its compensations in more ways than one, all of which cannot be enumerated here.

While attendance is not the only indication of the success of a meeting, and while numbers are not the full measure of the usefulness or virility of an organization, the fact remains that adequate representation in membership and attendance is essential to the full functioning of any group of professional men and women. In fairness to our entire Association, and in deference to the cosmopolitan character of our organization, we must move our annual meetings to the different sections of the country.

This year the selection of San Francisco proved most fortunate. The weather in contradistinction to that of many other sections of the country proved to be ideal, and not a moment of discom-

fort marred the perfect enjoyment of the event. The Local Committee on Arrangements had exerted themselves to the utmost to provide ample facilities for the meeting, and when the brief period since the New Orleans session is considered, their achievement should be commended most highly.

The entertainment was of a character befitting the traditional attractions of San Francisco and was greatly enjoyed, especially by those who had never been privileged to visit the West Coast before. The trip to Chinatown was typical of the glamour of this unique section of the city.

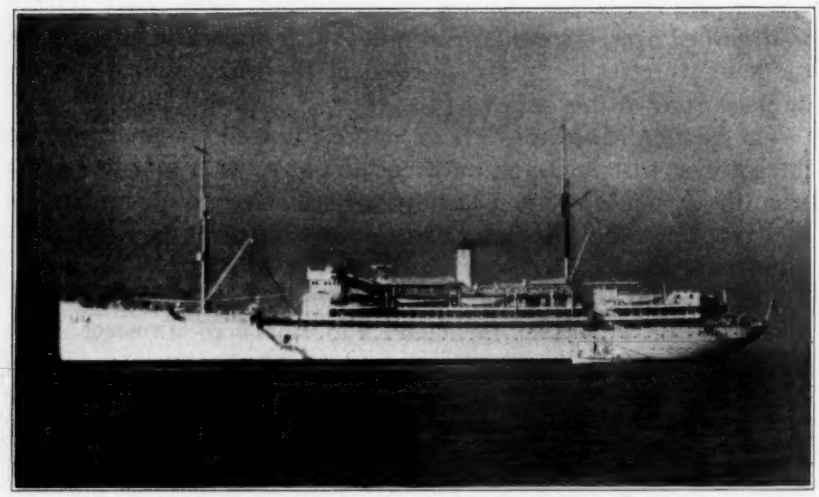
The general meetings, from the address of the President, George B. Winter, to the final adjournment, were characterized by dignified procedure and professional decorum. The problems of the hour were set forth in the presidential address, which appears on page 1609 of this issue.

The Section Meetings were exceptionally well attended, and the interest was sustained and most encouraging. It is safe to assume from the evidence presented at the various meetings of this Session that interest in advanced dentistry on the part of our members is rapidly increasing.

The executive functions of the organization were well represented in the House of Delegates and Board of Trustees. The personnel of these two bodies is always of the greatest importance, and the Association has for the most part been fortunate in this regard. The very best men in dentistry have ministered to the welfare of the profession and the people through the medium of these two bodies. Their functions are somewhat different and recognition of this fact should be given. No legislation can be enacted without sanction of the house, and thus the selection of men to serve as Delegates is most important. The state societies, at their annual meetings, select the men to represent them in the house, and these selections should be made with the utmost care. Representative government demands that this shall be the established procedure, but, in certain cases, the rank and file of the members do not deliberate so seriously as they should in the selection of these men. The best brains in the profession are needed for this kind of legislative work, not mere good fellowship or

camaraderie, and when a member accepts a position as Delegate, he should be impressed with the seriousness of his obligations. The proceedings of the house should be characterized by due deliberation and strict attention to the business in hand. In no other way can the Association function acceptably.

A word should be said at this time for the Board of Trustees. No one who has not served on the Board can imagine the sacrifice made in this service. Many a long hour of wearisome deliberation, often extending far into the night, is exacted of a Trustee, and too frequently the rank and file of the membership show small consideration for this work.



U.S.S. Relief, hospital ship of the United States Fleet.

A pleasant feature of the San Francisco Session was the large number of visiting dentists from other countries. It is always accepted as a very great compliment when distinguished visitors from foreign climes do us the honor of attending our meetings, and the 1936 Session was noted in this respect.

The presence in San Francisco of part of the U. S. Fleet made it possible for certain of the officers of the Navy to show a delightful courtesy to our Association. The Hospital Ship of the United States Fleet, U.S.S. *Relief* was in port, and the officers and delegates of the A.D.A. were invited to visit the *Relief* and

were tendered a luncheon on board. This courtesy on the part of the Navy will long be remembered by our members. The illustration herewith presented was forwarded by Capt. Lucius W. Johnson, of the Medical Corps.

The hotel facilities in San Francisco were ample and the hotel staffs cordial and cooperative, as were the citizens generally.

Altogether the 1936 meeting must be recorded as one of constructive achievement, and our members may well be congratulated.

The following officers were elected:

President, Leroy M. S. Miner

President Elect, C. Willard Camalier

Vice Presidents, Raoul H. Blanquie, J. V. Gentilly and J. A. Blue

Secretary, Harry B. Pinney

Treasurer, Roscoe H. Volland.

Atlantic City was selected as the next place of meeting.

JUST FIFTY YEARS AGO

C. Willard Camalier, President Elect of the Association, has handed the Editor an announcement of the meeting of the Association that was held fifty years ago. The organization was then known as the National Dental Association, and the announcement was as follows:

The
National Dental Association
of the
UNITED STATES OF AMERICA
will hold its
NEXT REGULAR MEETING
In Washington City,
in the
United States National Museum,
commencing
On Tuesday, July 27th, 1886,
At 11 o'clock A. M.

The following was the official call:

Dear Sir:

At this meeting attention will be given to the further completion of the permanent arrangement of the details of the organization of the Association.

A careful perusal of the Constitution will show the reader that the general plan is broad, thorough, and effective, if the details are arranged to accord with it.

A widespread interest has been awakened in the minds of many of the most prominent Dentists of the country, and they have promised to be present and co-operate in placing the Association in proper working order to accomplish the great work for which it is intended. When this shall have been done, those who have been laboring in this matter feel every assurance, from past correspondence with medical, scientific, and other officers of the United States, that it will receive from proper Government Departments many facilities in the pursuit of statistical and scientific information.

All are cordially invited to attend this and future meetings, and take part in perfecting such measures as will make the Association truly National in its workings and its achievements.

Very respectfully,

R. FINLEY HUNT, D.D.S.,
Secretary.

Officers

President—R. B. Winder.....Baltimore, Md.
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Article II

MEMBERSHIP

SECTION 1. The future membership of this Association shall be composed of Dentists, who may be elected upon application, which application shall be accompanied by credentials of membership in a State Society, or by a recommendation from five members of this Association or of his State Society.

This document will prove of great interest, not only to older

members, but also to the more recent recruits to our ranks. The history of the profession during that half century is embodied in no small degree in the proceedings and activities of the organization since the meeting of 1886. If it were possible to make a comparison, it would be somewhat surprising, and it would certainly be quite stimulating to compare the 1886 meeting with the one just held in San Francisco.

The developments in that fifty years are beyond the comprehension of most men. We travel so rapidly in these latter times that it is difficult to keep step with the onward march of our profession. This is all to the good, and it is in strict accord with the manifest destiny of our calling; in other words, we would not have it otherwise.

But there is something else needed in addition to speed: The demand most to be emphasized in these latter days is for men and measures that shall stand for a higher consecration to the finer and nobler concepts of our professional heritage.

We need not only a wider curriculum of activities, but also a more intense concentration on the better things of our profession. The stream must not only be wider, but it at the same time must be purified. This is the insistent need of the hour.

It is stimulating to travel as fast as we do, but it is even more important that we travel in the right direction.

A NEW CURE FOR ARTHRITIS

One day, the janitor of the Central Office of the American Dental Association turned up with a stiff and swollen knee, which was so painful that he was almost incapacitated.

All kinds of ordinary remedies were tried, such as massage and hot applications, to no avail. It was seen that he had several gold crowns in his mouth and therefore, presumably, several pulpless teeth. Fortunately, these were not removed. But the case became desperate, and the patient could not bend his knee or get relief in any way.

It was during the spell of excessive heat, and one day in desperation he turned on the cold water in the bath tub, and emptying

10 pounds of broken ice in the water, jumped in. The effect was almost magical. The swelling promptly went down, the pain ceased, the leg flexed, and all was well. It has remained so ever since, a matter of over a month.

"There are more things in heaven and earth, Horatio, than are dreamed of in your philosophy."

This does not mean that we recommend ice water for arthritis.

PRACTICE IN PARAGRAPHS

This department is intended for busy readers. It aims to tell a vivid story in a few words. Items should be of a practical character, and free from padding—not more than a paragraph or two. We exact no limit, but two hundred words can tell most of these stories. Send in your ideas; they will be welcome.

Flow of Wax—When the inlay wax is in the cavity, heat a large ball burnisher and cause the occlusal surface of the wax to flow.—*C. C. Norris, Oshkosh, Wis.*

A More Esthetic Porcelain Jacket Crown—Two sittings are required of the patient for preparation of the tooth. The operator reduces the tooth grossly, carrying the preparation almost to the normal gingiva at the first sitting, but before dismissing the patient, applying phenol to the partially prepared tooth carefully, fitting thereto a crown form filled with guttapercha or a like material and adjusting in such manner that the normal gingiva will be pushed 1 to 2 mm. apically. The patient is asked to return the following day (twenty-four hours), at which time the preparation can be completed 0.5 to 1 mm. beyond the normal gingival line, so that, when the crown is set, the gingiva will restore itself to normal position and there will be no visible cement line. The results are most gratifying.—*R. Philip Melvin, Winston-Salem, N. C.*

Specialist Vs. General Practitioner—Unusual and difficult impactions, especially of the third molar tooth, are logical conditions for surgical operation by the exodontia specialist. The general practitioner usually is inadequately equipped in skill, experience and practice, or even from the standpoint of sanitary environment. When a competent specialist has been engaged and trying postoperative conditions prevail, patients are inclined to consider the result just a natural sequence to an unnatural, abnormal condition. If a general practitioner should perform identically the same operation, healing might be considered as unusually slow, following a painful ordeal. When other undesirable postoperative conditions arise, prevail and persist, sometimes to the extent of prolonged mandibular numbness, patients might even criticize the general practitioner for his reluctance to refer such patients to the specialists. It is generally preferable to refer such patients, rather than wish we had.—*Herbert Ely Williams, Red Bank, N. J.*

Details Vs. Results—Nonessential, meaningless details are the chief stumbling blocks to gold foil and dental progress in general. Too many heats in the race often shut the runner out of the final entirely. Enough details are important, but too many are unnecessary and disastrous and bring weariness long before the final result is in sight. With a "here and there," "now and then" application of gold foil, unnecessary details exist in profusion, but when the ancient art becomes daily practice, habit supplants details and time saving efficiency overshadows the "fussing" coincidental with eternally "getting ready." Gold foil work is only as difficult as the dentist's conception of it and only as easy as the sitting position makes it.—*Herbert Ely Williams, Red Bank, N. J.*

Have All Phases of Dentistry Progressed?—The opinion of thoughtful dentists of today is that prosthetic procedures, casting technics, exodontia and certain other phases have made amazing progress, while purely operative dentistry, from the standpoint of permanence, has undergone a shameful depreciation. The inlay, of course, is a semilaboratory product, while gold foil should be the ultimate goal of every technician of operative dentistry. It seems a pity and almost calamitous that the younger dentists especially are ignoring the permanency of gold foil. But gold foil is not only returning, but also has returned to stay. Nonusers, recent graduates especially, should memorize the following, reconciling themselves, if they can, to its teaching: "You are a general practitioner. Your patient is seated in your newest model dental chair, gazing with admiration on your latest, modern equipment, including complete sterilization facilities. You are equipped theoretically and practically to meet the requirements of the best dental service. Your patient asks you frankly, 'Doctor, can you make an absolutely permanent and sterile filling like mother had? One that endured for fifty years?' And if your answer is 'No,' your six year course of intensive study, carrying a backbreaking overhead of $12,000, has been in vain."—*Herbert Ely Williams, Red Bank, N. J.*

Receiving the Child—As so much depends on the way a child is received at the office and the impression that the reception makes on him, the following suggestions are offered: The furnishings of the reception room and the manner of the dentist and the assistant should assure the child that he has come into an atmosphere of friendliness and is among friends, although overeffusiveness may defeat its purpose. Remember that the fear of the unknown and of the hitherto inexperienced is probably the greatest fear that a child has and a friendly and helpful spirit must be made evident at the start. It is a good thing to pay some regard to the tastes of child patients in the furnishings of the reception room. A child's chair, perhaps an assortment of books for children, helps to create the desired atmosphere. If at all possible, find out the child's first name beforehand, so that you can employ it in addressing him or her. That apparently simple thing goes a long way toward establishing friendly relations. Sometimes, on this first visit or in the early part of it, an examination of the mouth can be made in the reception room. This is in the case of very timid children, but, whenever possible, it is best to have them come into the operating room so that they can see the whole office and have their fears and apprehensions dispelled by actual sight of and contact with the mysterious equipment that a dentist has.—*Edward C. Duryee, Peekskill, N. Y.*

COUNCIL ON DENTAL THERAPEUTICS

ACCEPTED DENTAL REMEDIES

The following articles have been accepted as conforming to the rules of the Council on Dental Therapeutics of the American Dental Association. The Council wishes dentists to understand that the admission of an article does not imply a recommendation. A copy of the rules that govern the Council in the consideration of articles will be sent on request.

SAMUEL M. GORDON, *Secretary.*

COD LIVER OIL AND RELATED SUBSTANCES*

White's Cod Liver Oil Concentrate (Liquid).—A concentrate of the unsaponifiable fraction of cod liver oil dissolved in sufficient cod liver oil to give the desired potency to the finished product. It has a vitamin A potency of not less than 60,000 units (U.S.P.) per gram and a vitamin D potency of not less than 8,500 units (U.S.P.) per gram.

ACTIONS AND USES: It possesses properties similar to those of cod liver oil as far as these depend on the fat soluble vitamin content of the latter.

DOSAGE: For the liquid: Infants, 6 to 8 drops daily; children, 2 to 4 drops, three times daily; adults, 4 drops three times daily. The liquid is marketed with a dropper designed to supply two-thirds minim (0.041 c.c.) in each 2 drops. For the capsules: Children, 1 capsule daily; adults, 1 to 2 capsules daily.

Manufactured by White Laboratories, Inc., Newark, N. J. U. S. patent 1,984,858.

White's Cod Liver Oil Concentrate Capsules, 3 minims: Each capsule contains White's Cod Liver Oil Concentrate (Liquid), 3 minims, and has a vitamin A potency of not less than 10,260 units (U.S.P.) and a vitamin D potency of not less than 1,453 units (U.S.P.).

White's Cod Liver Oil Concentrate Liquid, Vials, 50 c.c.: Each two-thirds minim (0.038 gm.) has a vitamin A potency of not less than 2,280 units (U.S.P.) and a vitamin D potency of not less than 323 units (U.S.P.).

White's Cod Liver Oil Concentrate Liquid, Vials, 5 c.c.: Each two-thirds minim (0.038 gm.) has a vitamin A potency of not less than 2,280 units (U.S.P.) and a vitamin D potency of not less than 323 units (U.S.P.).

VIOSTEROL†

Winthrop Viosterol in Oil.—A brand of viosterol in oil, U.S.P.

Manufactured by the Winthrop Chemical Co., Inc., New York City, under U. S. patent 1,680,818 (Aug. 14, 1928; expires 1945) and 1,871,136 (Aug. 9, 1932; expires 1949) by license of the Wisconsin Alumni Research Foundation.

ANESTHETICS—LOCAL‡

Dental Ointment Butyn 4% and Metaphen 1:1500.—Butyn, 4% with metaphen 1:1500, in a base of white petrolatum, wool fat, and white beeswax, with eugenol 0.1 per cent and menthol 0.5 per cent.

*A.D.R. 1935, p. 82.
†A.D.R. 1935, p. 89.
‡A.D.R. 1935, p. 39.

ACTIONS AND USES: See Butyn (A.D.R. 1935, p. 39).
Manufactured by Abbott Laboratories, North Chicago, Ill.

LOCAL ANESTHETICS*

Minimax Procaine Solution 2% with Epinephrine, 1:30,000: Each cubic centimeter contains procaine hydrochloride, U.S.P., 20 mg.; epinephrine, 0.033 mg.; disodium phosphate, 3 mg.; sodium bisulfite, 1.5 mg.; sodium chloride, 2.65 mg.; and distilled water.
Manufactured by Minimax Co., Chicago, Illinois. No U. S. patent or trademark.
Minimax Procaine Solution 2% with Epinephrine 1:30,000 in cartridges.

Minimax Procaine Solution 2% with Epinephrine 1:50,000: Each cubic centimeter contains procaine hydrochloride, U.S.P., 20 mg.; epinephrine, 0.02 mg.; disodium phosphate, 3 mg.; sodium bisulfite, 1.5 mg.; sodium chloride, 2.65 mg.; and distilled water.
Manufactured by Minimax Co., Chicago, Ill. No U. S. patent or trademark.
Minimax Procaine Solution 2% with Epinephrine 1:50,000 in cartridges.

PHOS-CAL—NOT ACCEPTABLE FOR A.D.R.

The report which follows on Phos-Cal was sent to the firm after adoption by the Council, although the product had not been submitted to the Council by the firm. Receipt of the report by the firm was not acknowledged. The Council therefore authorized publication of the report for the information contained therein.

SAMUEL M. GORDON, *Secretary.*

Phos-Cal is the name given by McKesson & Robbins, Inc., to a preparation which is said to contain assimilable calcium and phosphorus in the same relationship as in milk. Its use is stated to be the "Newest Improved Form of Calcium-Phosphorus Therapy," and it contains 20.0 per cent of calcium and 11.7 per cent of phosphorus (Ca:P—1.71).

In advertising the material to the dental profession, emphasis is placed on the contention that the average American diet is far too low in calcium content. Reference is made to the article by Bernheim *(J.A.M.A.,* 100:1002 [April] 1933), who stated that of 4,000 diets studied, 3,998 were deficient in calcium. According to the advertisement, statistics show that 57.3 per cent of diets are too low in calcium, and 61.8 per cent are too low in phosphorus. Phos-Cal, it is claimed, adequately meets this need by supplying in a pleasant, tasty form the protein-calcium-phosphorus fraction of milk.

Much is made of the natural distaste for milk, allergy toward it, its exceptional bulk and fear of its fattening propensities. It is inferred that Phos-Cal has all the calcium-phosphorus value of milk, with none of the disadvantages attending the use of milk.

The Council does not agree that the American diet is greatly deficient in calcium and phosphorus. This was discussed in some detail in a general report on calcium and phosphorus compounds in dentistry *(J.A.D.A.,* 23:139 [Jan.] 1936). Nor, as far as general experience goes, is there much natural distaste for milk, or allergy toward it. If one cannot tolerate milk, calcium can be supplied readily by other easily available foods.

There is no convincing evidence available that when diets adequate in calcium and phosphorus and vitamin D are given, the addition of compounds of calcium and phosphorus, whether inorganic or organic, is necessary to assure healing of bone fractures, increase in blood coagulation, prevention of rickets and malformation of teeth or in proper development of the fetus.

No evidence is available in the dental or medical literature that any benefits are derived

*A.D.R. 1935, p. 34.

from the indiscriminate use of Phos-Cal. Its promotion emphasizes an unproved factor at the expense of those factors that have been found useful in the prevention or control of dental caries; namely, an adequate dietary, hygienic measures and proper local care.

If one grants the desirability of adding calcium-phosphorus compounds to the diet, it is worthy of note that experiments carried out many years ago show that calcium-phosphorus compounds from almost any source are utilized, provided the conditions for absorption are proper. In the decade and a half from 1895 to 1910, there was a wide-spread belief that the presence of organically bound phosphorus was of great importance, and while this statement is not definitely made in the promotion of Phos-Cal, it is at least inferred. It may be pointed out that in cow's milk a greater part of the phosphorus exists as inorganic phosphate, and it serves as a proper food for the young at a time when the demand for phosphorus is greatest.

In 1907, McCollum showed that the body can use inorganic phosphates to meet all its phosphorus demands. The only source of calcium, in McCollum's experiments, was finely ground tricalcium phosphate. Analysis of a rat's body after death showed it to be of normal composition, and this ended the discussion about the possibility of animal's synthesizing their own phosphorized protein and fats from inorganic calcium phosphate ("Newer Knowledge of Nutrition," 1929, p. 11).

The promotion of Phos-Cal is a further attempt to revive a discarded theory, which appears to have been satisfactorily disposed of with the statement of Mendel that " . . . the once debated question of superiority of calcium and phosphorus and iron, when furnished in some organic form or combination, no longer excites interest. . . ." As already mentioned in the general report, Steenbock and co-workers found no difference in the growth of young rats when the calcium was obtained from different sources.

Until such evidence as mentioned above is forthcoming, the Council cannot admit Phos-Cal to A.D.R.

In view of the unacceptability of the product, there is no discussion concerning the acceptance of the proprietary name Phos-Cal.

CALCIPHOS—NOT ACCEPTABLE TO A.D.R.

The report on Calciphos which follows was sent to the firm after adoption by the Council, although the product had not been submitted to the Council by the firm. The firm submitted no evidence which would cause a material revision of the Council's statements. The report was therefore authorized for publication for the information contained therein.

SAMUEL M. GORDON, *Secretary.*

Calciphos, put out by Bilhuber-Knoll Corporation, Jersey City, N. J., is said to be an innovation in calcium medication. It is hexacalcium and tetraferrihexaphosphate of inosite, containing approximately 17 per cent calcium, 15 per cent phosphorus and 2 per cent iron. Later advertising states that the product contains 19 per cent calcium in place of the 17 per cent mentioned in earlier advertising. It is said to be "a high concentration of minerals necessary for the vital processes, combined in a balance that favors their effective assimilation."

Its indications are for the "treatment and prevention of diseases and conditions of the teeth, their softness and decay, due to calcium deficiency."

The dose for children and adults, with no discrimination as to age or condition, is 2 tablets (6 grains each) or their equivalent in Calciphos powder, one-half level teaspoonful, three times a day.

No evidence is available that Calciphos alone or when added to the diet is useful for the treatment and prevention of disease conditions of the teeth or softness and decay due

to calcium deficiency. Indeed, the writer of the advertisement shows a lack of knowledge of dental conditions, for the blanket recommendation indicates that dental diseases of the teeth are due to some single condition.

As already pointed out, despite all of the investigations carried out, the most that can be said for the use of calcium and phosphorus is that these should be supplied as part of an adequate diet in combination with the vitamin mobilizing factors.

In the report on Phos-Cal (*J.A.D.A.*, 23:1771 [Sept.] 1936), the availability of calcium and phosphorus from inorganic or organic salts was discussed. The same remarks apply to Calciphos.

As far as available evidence goes, there is none that is acceptable to the effect that phosphorus or calcium from organic salts is more readily assimilated than those from inorganic salts. Until more evidence becomes available, the indiscriminate use of Calciphos for the treatment and prevention of conditions for which it is recommended is irrational. Its use tends to divert emphasis from those conditions that are known to control or prevent dental caries at the present time.

In view of the unacceptability of the product, there is no discussion concerning the acceptance of the proprietary designation Calciphos.

Until such evidence as mentioned above is forthcoming, the Council declares Calciphos not acceptable for A.D.R.

ORA-NOID CONTEST WITH GOVERNMENT CONCLUDED

The following is taken from a Press Release of the United States Department of Agriculture:

The report of the termination of one patent medicine case concludes the June statement of prosecutions involving drugs. Henry Lutzenkirchen, trading as the Ora-Noid Co., Chicago, Ill., dropped his intended contest of the government's case against him, based on a shipment of his product "Ora-Noid," and was fined $50 and costs. "Ora-Noid," half table salt and the remainder consisting of chalk, baking soda, magnesium and potassium sulphates and phosphates, flavored with an essential oil, was offered as a "complete oral prophylactic." Claims charged by the government to be false and fraudulent included these: "It keeps the gums in condition; it strengthens all the tissues of the mouth including the tongue, the palate, the throat and the mucous membranes on the inside of the cheeks. The use of Ora-Noid mouth powder alone, according to directions, performs the function of keeping the teeth, gums, tongue, mouth and throat healthy. It expels germs. It draws the fluids out of inflamed tissues, thereby relieving congestion." These fraudulent claims have now been removed from the labeling of the product.

BUREAU OF PUBLIC RELATIONS

CAN RURAL DENTAL SERVICE BE GIVEN AT REASONABLE COST?

By KENNETH R. GIBSON,* D.D.S., Detroit, Mich.

THE purpose of this paper is to describe one of the many commendable activities of the Children's Fund of Michigan. We are depicting it in some detail in order that interested persons, organizations and societies can apply, with such modifications as local conditions may necessitate, the principles that have made the project a success when evaluated in terms of money cost and results accruing from professional services rendered.

For a comprehensive understanding of the initiation of the Fund, its objectives, capital structure, expenditures, duration and management and a description of its activities, those concerned are referred to the trust document and annual reports. Suffice it to say here that the policy that has prevailed since the inception of the Fund is that the largest portion of disbursements shall be in the field of child health.

In the Child Health Division, there are three dental programs: the regular dental, the Detroit dental and the summer dental relief programs. These have met one of the most needed child health services in the State of Michigan.

Michigan is a state covering 57,000 square miles, divided into eighty-three counties, with a population of approximately 4,000,000 people. It is divided into two peninsulas by Lake Michigan, the Straits of Mackinac and Lake Huron. The upper section is known as the Upper Peninsula, with thirteen counties, and the lower section is called the Lower Peninsula, with seventy counties. Though the two sections of the state vary widely in the number of counties and population, the Upper and Lower peninsulas are about the same size. They differ widely in wealth, industry and social and health advantages.

For many years, the Upper Peninsula has seen a steady retrogression in employment and industry. Lumber and mining, its principal sources of gainful occupation, have steadily declined. Agriculture, owing to lack of fertility of the soil and the fact that the growing season is short, has never been of consequence. Approximately 48.2 per cent of its people are, or have been, on welfare rolls.

The northern half of the Lower Peninsula, with the exception of a narrow strip along the east and west coasts, is like the Upper Peninsula, except that it has never enjoyed more than the one industry, lumbering. Now its forests are gone, and vast stretches of barren, desolate waste lands remain, a constant reminder of the ruthless manner in which the lumber men plied their trade. The average county welfare load in this area was about 46.4 per cent.

*Director, Dental Division, Children's Fund of Michigan.

Only in the southern half of the Lower Peninsula can it be said that the state enjoys a fair measure of prosperity. Here are located productive agricultural sections and the large manufacturing areas. Even in this area, approximately 21.2 per cent of the people have been on relief rolls.

While the children of our larger cities have long enjoyed health services, health facilities in the Upper Peninsula and northern half of the Lower Peninsula have been entirely lacking, except in isolated instances. It was not surprising, then, to find that the incidence of dental caries among children ranged from 90 to 95 per cent in the districts described. The poverty of its people and the lack of health ministrations were the determining factors in our decision to augment the regular dental program with special summer dental relief programs.

The summer dental relief program is our solution to the question "Can rural dental service be given at reasonable cost?" It is a short, intensive project limited to operative work and given each year in about twenty of the poorest counties in the state. It extends over a period of twelve weeks. Dental service, in this program, as in all Children's Fund of Michigan dental programs, is limited to children whose parents cannot pay for dental treatment. Fifteen years is the age limit.

The objectives of this endeavor are twofold: (1) to accomplish a large amount of good operative work in the

TABLE 1.—COST ANALYSIS OF THE 1934 SUMMER DENTAL RELIEF PROGRAM*

Salaries		$10,515.00
Staff:		
14 dentists at $125 a month, 3 months	$5,250.00	
6 dentists at $150 a month, plus $50 a month maintenance, 3 months	4,080.00	
1 dentist at $150 a month, plus $50 a month maintenance, 2½ months		
Supervising dentist at $275 a month, plus $4 a day maintenance, 3 months	1,185.00	
Other Expenses		$ 5,747.46
Supplies	$2,213.25	
Equipment (10% of valuation of equipment—21 units at $500=$10,500)	1,050.00	
Printing (forms)	296.98	
Telephone and telegraph	9.11	
Postage	20.49	
Freight and express, 21 units to and from job	139.32	
Repairs	500.49	
Special emergency operative costs	8.00	
Auto mileage	1,189.82	
Supervising dentist, 5,000 miles at $0.06 a mile	$300.00	
To get 21 dentists to and from job, including meals and hotel expense	889.82	
Stenographer's and director's time	320.00	
Total cost		$16,262.46
Average cost per county unit		$774.40

*Children's Fund of Michigan cost on basis of a three-month, twenty-one-county program, employing twenty-one operating dentists and one supervising dentist.

shortest possible time; and (2) to interest, train and give experience to the recent graduate in what we believe to be the most important and most neglected branch of dentistry, children's dentistry.

Selection of the staff, organization for the work within the county and competent supervision of operative treatment when the program is under way are of prime importance to a project of this nature if it is to be of value.

We are frequently asked to be specific in naming the qualifications that we believe to be essential in the applicant. They are, in what we believe to be the order of their importance:

1. A genuine desire to become proficient in children's dentistry and in the management of the child patient.
2. An honest liking for children.
3. A better than average record in both academic and clinical studies.

TABLE 2.—ESTIMATED COST TO DUPLICATE CHILDREN'S FUND OF MICHIGAN SUMMER DENTAL RELIEF PROGRAM*

Salaries		$ 8,700.00
Staff:		
21 dentists at $125 a month, three months	$ 7,875.00	
1 supervising dentist at $275 a month, three months	825.00	
Other Expenses		14,850.00
Supplies, 21 at $110 each to cover 3 month period	$ 2,310.00	
Equipment, 21 units at $500 each	10,500.00	
Printing (forms)	300.00	
Telephone and telegraph	10.00	
Postage	20.00	
Freight and express, 21 units to and from job	140.00	
Repairs—none first year		
Special emergency operative costs	50.00	
Auto mileage	1,200.00	
Supervising dentist, 5,000 miles at $0.06 a mile	$300.00	
To get 21 dentists to and from job, including meals and hotel expense	900.00	
Stenographer's and director's time	320.00	
Estimated total cost		$23,550.00
Estimated average cost per county unit, first year, for 21-county, 3-months program		$1,214.28

*Twenty-one-county dental program, three months, with supervision.

For the most part, the staff has been recruited from the graduating class of the School of Dentistry, University of Michigan. Those graduating students who are interested in affiliating with the Fund for the summer program are individually interviewed and their qualifications carefully checked. Since a project can only be as good as the men who are actually engaged in its productive work, every effort is made to select competent personnel.

4. The ability to get along harmoniously with people.
5. A clean-cut, wholesome appearance.

The boy who is "just looking for a job" is not considered.

Organization for the work of the summer program within the counties begins several weeks in advance of the staff selection. Just as soon as which and how many of the eighty-three counties in the state are to receive service has been determined, an organizer in and for each

county is chosen. To that one person is given the task and complete responsibility of preparing the county for the approaching dental service.

The person most ideally situated for the job, from the standpoint of experience, knowledge of the people within the county, geography and health conditions, is the county nurse. Usually she is well-trained in public health work and of mature years and proved organization ability. We are particularly fortunate in that, in more than half the counties chosen for summer programs, the aid of the county nurse is available.

The lack of a county nurse, though making the problem more difficult, is not an actual preventive of the project.

An interested member of a county parent-teacher's association, a progressive, socially minded county commissioner of schools, a newspaper editor with the welfare of the children of his county at heart and progressive dentists have all acted successfully in our programs as county organizers.

Some leisure time, the use or ownership of a car, ability to persuade people to work and the wish to be of service are some of the prerequisites of the successful organizer.

The organizers for each county having been determined and the responsibility accepted by him or her, the next step has been to supply the organizer with complete directions, information and the conditions under which the Children's Fund will make provision for a program. This has been done either by letter from the home office or by letter and personal visit to the county.

The first duty of the organizer is to form a county dental advisory committee. Here, a knowledge as to the persons who will accept responsibility stands the organizer in good stead. We suggest that from five to ten responsible persons compose the committee. Such a committee should include the county commissioner of schools, a well-known superintendent of schools, a judge of probate, the chairman of the county board of supervisors,

TABLE 3.—ESTIMATED COST TO ESTABLISH SINGLE COUNTY DENTAL RELIEF PROGRAM*

Salary		$ 375.00
Staff:		
1 dentist at $125 a month, three months	$375.00	
Dental supervision, committee of dentists		
Other expenses		704.00
Supplies, 1 unit at $110 to cover 3 month period	$110.00	
Equipment, 1 unit at $500 each	500.00	
Printing (forms)	25.00	
Telephone and telegraph		
Postage	2.00	
Freight and express	7.00	
Repairs, none first year		
Special emergency operative costs, none (committee of dentists)		
Auto mileage	60.00	
Supervising dentist, none (committee of local dentists)		
To get 1 dentist to job and return	$60.00	
Total estimated cost for three-month program		$1,079.00

*Local committee of dentists to act in supervisory capacity, three month basis.

a parent-teacher association president, secretary or influential member, the president of a men's service club and a leading dentist, clergyman, banker, etc. A large committee is unwieldy, a small, interested committee functioning best.

To this county dental advisory committee, the organizer carefully explains the obligations of the committee and the conditions under which the Children's Fund of Michigan will arrange for a summer dental program in the county.

The obligations of the committee are as follows:

1. To provide, without cost to the Children's Fund:

(*a*) a full-time dental assistant to work in the clinic for the period of the program. The paid assistant has been proved more satisfactory than the volunteer worker.

(*b*) suitable quarters to carry on the work; i.e., a room or rooms well provided with natural light, having window screens, heated when necessary and so situated as to be available to the greatest number of children. Running water and electricity are desirable, but not essential. Daily janitor service for the operating room is required.

(*c*) any necessary transportation of equipment between clinics located in the county and any necessary transportation of children to and from the clinic.

2. To determine the eligibility of children for treatment. Lists of school children obtained from the teachers should be checked as to eligibility for free treat-

Table 4.—Summer Dental Relief Program Statistical Report of Services with Average Cost per Service*

Total visits, clinic patients			15,826	Total cost of program $16,262.46
First visits		14,283		
Subsequent visits		1,543		Average cost per visit $1.03
Total services given			57,520	
Prophylaxis		2,236		Average number of services per visit, not including examinations or local anesthesia 3.6
Extractions, total		17,657		
Deciduous teeth	14,363			
Permanent teeth	3,294			
Local anesthetic†		7,826		Average cost per Service $0.28
Pulp capping		787		
Cement bases		8,273		
Silver nitrate treatments		3,758		
Fillings, total		24,153		
Silver amalgam	22,446			
Copper amalgam	7			
Cement	459			
Synthetic porcelain	1,241			
Treatment for gingivitis		67		
Treatment for Vincent's infection		8		
Miscellaneous operations		581		
Cases completed in clinic†		1,615		

*June 25 to Sept. 15, 1934; services of twenty dentists. The other member of the summer staff substituted for the regular dental staff dentist, who acts as summer dental supervisor. Thus, his reports are entered with the regular dental program records.

†Not included as a service given.

ment by the school teachers and then by the committee members. Any local dentists should be invited to act with the committee in this capacity.

3. To distribute to all eligible children parent consent cards and see that they return these cards to the clinic signed by their parents. No child may receive treatment without the permission of his parents or guardian. The child returns the card on his first visit to the clinic.

4. To make appointments for children so that the dentist will be provided with a minimum of twelve patients and a maximum of eighteen patients per day. As far as possible, the dentist should be supplied with new patients until all eligible children have had one clinic visit, before return appointments are made. To guard against time being lost because of broken appointments, the committee is to prepare for each clinic location an emergency list of children who can be called in easily whenever broken appointments occur.

The committee having agreed to fulfil these obligations and conditions, the organizer is empowered to promise that the Children's Fund will send a dentist to the county and will provide his salary, equipment, materials, and supplies for the twelve-week period.

Such acceptance of conditions is forwarded to the home office, together with a list of the proposed clinic locations and dates of operation at each, and the names of the committee members and their addresses.

As the above-mentioned work of the county organizer and the dental advisory committee occupies several weeks, it is important that most of it be out of the way before the schools close for the summer vacation period.

The responsibility for the training of the dental staff and active supervision of the program is vested in a dentist supervisor. It is his task to see that the staff is duly assembled before the opening date of the project, to conduct a school of training in our ideals of service, methods of operative procedure and methods of recording and reporting. The dentist who is to go to the county is as thoroughly grounded in his work and the conditions surrounding it as is possible. After the program has begun, the supervisor spends his entire time on the road, checking operative work, assisting the dentists, ironing out any difficulties that may arise and, in general, keeping a close watch on the work until the program closes.

One has often heard the statement that school dental work or dental work conducted in a public health program is not good work. Such a statement usually discloses a lack of knowledge of the subject.

Given a staff of competent, carefully trained dentists, appointed through merit rather than through political influence, and supplied with adequate equipment and under constant strict and careful supervision, and there is no reason that public health dental work done by such a group cannot equal like dental operations performed in any practitioner's office.

With the thought that specific questions and answers will bring out essential points not otherwise covered, I repeat and answer certain of the many interrogations concerning the summer dental relief program.

How do you define "indigent children"?

For our purposes, "indigent children" are those whose parents cannot pay for dental treatment. They do not have to belong to the group receiving welfare or relief aid. If, in the opinion of the dental advisory committee, a committee of local people, the financial circumstances of the family are such as to preclude the possibility of his going to the family dentist, the child may be referred to our clinic.

When do you make the dental inspections?

The answer is that we, meaning our dentists, do not make the dental inspections. The dental inspections are made by the nurse or school teachers after the class room lists have been drawn up and eligibility has been determined. All we want to know at this time is whether the child requires treatment, not what treatment nor how extensive.

When do you make the dental examinations?

Dental examination embracing exploration, diagnosis and recording on the clinic charts is the first service performed for the children in the clinic. Examinations are made by the dentist on the first visits of the children during each year's summer program and not on subsequent visits of that summer.

What kind of equipment do you use?

For the summer dental relief program, we use an equipment designed for portability. Chairs are of the folding type, light, stronger than they look and easily set up or taken down.

Since many of the clinics are located in districts not provided with electric current, or with current of standard voltage, we depend for the most part on the foot engine, though electric engines are provided certain clinics. In the latter case, these are of the pedestal type.

A student's operating case is provided to hold instruments. The cuspidor is of the common tin variety, emptied and cleaned between appointments.

Equipment and supplies, sent to the organizers in one large sturdy box before the program opens, are set up by the dentist on his arrival, and are so selected that they may be readily repacked in the box, placed in any type of conveyance and transported to the next clinic location.

What kind of dental work do you do?

Amalgam fillings and synthetic fillings, as necessary, extractions and prophylactic treatments make up the bulk of operative work. We list treatment in the following order of importance.

1. Elimination of mouth infection. This means the extraction of all diseased teeth that cannot be successfully filled or treated.
2. Conservation of the permanent teeth through preventive or reparative treatment.
3. Conservation of the deciduous teeth.
4. Prophylaxis.

How do you arrange for transportation of children to the clinic?

Necessary transportation of children to the clinic is provided for in a variety of ways. A committee member's car often is the means of transportation from one section of the county. School buses are used in others. Frequently, children come on horseback. In many instances, they have walked a distance of 6 miles. Transportation is not a problem when people are interested and organization has been well handled.

How many children do you see daily?

On week days, clinic hours are from 9 a.m. to 4 p.m., with one hour for lunch, a six-hour working day. As one half hour is allowed for each patient, the minimum number of children seen daily is twelve.

How much can a dentist do in half an hour?

Naturally, the amount of dental treatment which can be given a child in half an hour depends on the individual equation. With a reasonably cooperative patient, a reasonably rapid operator will produce a surprising amount of good work. The dentist will not be able to give all the treatment that the average child will need, but he will be able to eliminate most of the oral infection and still be able to do some preventive or reparative work. The following is the

order of procedure with most children:

1. Examination of hard and soft tissues of the mouth, results being noted on the child's clinic chart by the assistant.
2. Conduction anesthesia, if extractions are necessary.
3. Operative or preventive treatment of permanent teeth, if required, while waiting for anesthesia.
4. Extraction of hopelessly diseased teeth.

How many different children do you see during the summer?

As far as possible, one clinic visit is allowed to each child until the eligibility lists have been exhausted, when return appointments are permissible. With a twelve-week program and a five and one half day operating week, and seeing twelve different children daily for one half hour each, it is possible to see 792 different children during the term of the project in each county. Allowing for two holidays during the summer and one day of lost time for each dentist, the twenty-one-county program could be made to serve approximately 15,876 different children with one clinic visit, or a total of 15,876 clinic visits.

How many clinics do you have in a county?

The county dental advisory committee determines the number of clinic locations that will most efficiently serve the county. No more than four clinic locations are allowed in any one county and three is the number recommended. Clinic locations are selected with the idea of making them central to the largest number of children. If the committee decided that three locations were necessary, the dentist would, in all probability, spend four weeks in each location. One dentist only is furnished each county.

How do you take care of "difficult-to-manage" children?

Fortunately, the majority of the children treated in our clinics are good patients. It is only the minority that cause any difficulty and present a problem in management.

The employment of physical force to compel a child to submit to dental treatment is taboo. Whereas this form of management may be employed judiciously in a private practice, it has, we believe, no place in a public health program. Too, the time that would be consumed coaxing, pleading with or forcing a child to undergo treatment could be more profitably employed in working for another child.

Instructions to the dentists are: "If you cannot operate for a child within five minutes, dismiss him, but do it pleasantly. Try again at a subsequent visit after he has been allowed to observe other children in the chair."

Why don't you work for children over 15 years of age?

There are two reasons that we do not work for children over this age: (1) there are more children in any county than we can hope to treat, and (2) at this age, the damage has been done; whereas, with the younger child, preventive as well as reparative treatment is a possibility.

Why don't you do educational (lecture) work too?

It must be remembered that the beneficiaries of the service are children whose parents cannot pay for adequate dental attention. All the lectures that could be given would not reduce the incidence of their dental caries by 1 per cent. These children need dental treatment, preventive and reparative, not further incentive to seek dental care.

Can such a program operate effectively during the summer when schools are closed?

The answer is yes, provided the organizer does his work well, the county dental advisory committee is interested and will-

ing to work and the parents themselves have an appreciation of the service being given their children.

As proof that a summer dental relief program can be made to operate effectively during the summer period, there is the statistical record for the 1934 program, which shows that, under the service of only twenty dentists (the work of one having been reported on another program), 14,283 different children received treatment and 15,826 clinic visits were made. A nearly perfect record for a twenty-one man program as stated previously would be approximately 15,876 clinic visits.

Isn't the summer dental relief program state or panel dentistry?

A definition of what constitutes state or panel dentistry will quickly dispel any fear that our program can be classed in either category.

Though the terms "state dentistry" or "panel dentistry" are often used synonymously, strictly speaking they are not the same thing. State dentistry is a system of dental practice supported and controlled by the government. "Panel dentistry is a system of national dental insurance and treatment, carried on by the large insurance groups of England and under the supervision of the government."[1]

Dental service in any of the Children's Fund of Michigan dental programs is given without charge to indigent children only, not over 15 years of age nor beyond the eighth grade. No adult may receive any dental service. The work is financed wholly by a charitable trustee corporation interested in increasing the health and welfare of children.

Because all Children's Fund dental programs arouse an interest in dental care in children whose parents can pay for their treatment, thousands of children yearly are referred to the family dentist for professional care.

The dental policies of the organization are formulated by a dental advisory committee composed entirely of dentists, among whom will be found leaders of the dental profession.

What was the cost of the 1934 summer program and what was accomplished?

The total cost was $16,262.46. A cost analysis of the 1934 summer program is given in Table 1. Table 2 gives an estimate of the cost of duplicating the program; Table 3, an estimate of the cost of a single county program, and Table 4, a report of services, with average cost of each.

In describing the work of the summer dental relief program, no assertion is made that it is the complete answer to the need of underprivileged children for dental service.

Each year, however, as we return to counties that had the program in preceding summers, we are able to note an improvement in the oral conditions of children.

To date, we have had the generous cooperation and approval of the dental profession in Michigan. There has been a gradually increasing appreciation of the need for children's dentistry as a public health measure, both in the profession and among the laity. If we can continue to promote this interest, to refer children who can pay to the office of the private practitioner and to receive in our clinics those whose financial circumstances will not allow of private care, noting each year an improvement in the oral health of our future citizens, we shall feel that we have contributed in part to the general objective of the Fund; i.e., promoting the health, welfare, growth and development of the children of Michigan, and, indirectly, elsewhere in the world.

1. Oral Hyg., 20:1235 (June) 1930.

Twentieth Annual Session of the National Dental Association, Louisville, Ky., July 26, 1916.

THE DENTAL PROFESSION'S CONTRIBUTION TO SOCIETY*

By GEORGE B. WINTER,† D.D.S., St. Louis, Mo.

ANNOUNCER: San Francisco's Civic Exposition Auditorium has taken on all the airs and appearances of a stately university campus. Since early Sunday morning, a constant stream of men—members of the American Dental Association—have slowly passed the registrar's long narrow desk, and entered the auditorium's vast interior, for a preview of the clinics to be presented during the coming week. Imagine, if you can, a university with an enrollment of from 6,000 to 7,000 students ranging in age from early adulthood through middle age to old age, including, if you please, a goodly number of septuagenarians—all intently studying one subject. An enormous postgraduate course, presented on the western slope of the Rockies in the shadow of the Golden Gate, drawing students from every state in the Union. They are all students here for the same eager purpose—to learn of the latest developments, the newest technics and the most recent scientific discoveries in the field of dental science.

To give you an idea of the dental profession's contribution to humanity, we present Dr. George B. Winter, President of the American Dental Association, who is here in San Francisco for the Annual Session of the Association.

Dr. Winter: Thank you, Mr. Blank, for your excellent analogy. The annual meetings of the American Dental Association are indeed a systematized, highly organized, synchronized collection of postgraduate courses in dentistry. To those of us who for years have watched the progress of our profession, meetings of this kind give a distinct thrill—the same type of thrill that ball players feel when they play and win a good game—the same type of thrill that a business man feels when he turns a good deal—the thrill of accomplishment. The six to seven thousand men and women whom you will see at your auditorium this week are representatives of the 40,000 members of our Association, who are located in every state, county and city in America; men and women who are directing their energy, thought and years of training to the relief of suffering, the prevention of disease and the improvement of the appearance and health of their fellowmen.

To those of us who have spent a lifetime in dentistry, our annual meetings, such as the one now being held in San Francisco and which, by the way, is the seventy-eighth, mean much. To us, they represent milestones marking with definite distinctness the slow but steady proggress which our profession has made in our contribution to humanity.

Announcer: I imagine, Dr. Winter, that there is quite a contrast between present-day dental conventions and those held, say, thirty or forty years ago.

Dr. Winter: Yes, indeed—not only in

*Radio talk given over Columbia Coast to Coast Broadcasting System at the Seventy-Eighth Annual Session of the American Dental Association, San Francisco, Calif., July 13, 1936.

†President of the American Dental Association, 1935-1936.

the type and quality of the conventions, but also in the practice of dentistry itself. When I stop to think of the tremendous advances that have taken place within the memory of men now living, I am amazed. But I suppose only dentists are interested in that.

Announcer: On the contrary, Doctor, the average intelligent American citizen is interested in all scientific advancement. He is particularly interested in the developmental stages of those sciences which affect health. We all realize that the early struggles and hardships, the progress and accomplishments of your profession, your efforts to improve your contributions to society are extremely important to the health of the nation. Tell us about them.

Dr. Winter: Very well. Briefly, let's consider one or two of the most interesting high lights in the history and progress of American dentistry.

When you walk into your dentist's office today and seat yourself in his modern, comfortable chair, let your mind drift back to the early days of your grandfather, some seventy-five or eighty years ago. Contrast the modern equipment—sterilizers, x-ray machine, diagnostic lamps, pulp testers, local and general anesthesia appliances, electric motors, compressed air and delicate microscopic instruments—with the crude, and almost barbaric equipment of the early eighteenth century dentist. Picture the plight of your grandparent. Driven to distraction by an aching tooth, he was forced to ride miles to the nearest city that boasted a dental surgeon. Or perhaps, for want of time, he submitted to the dubious ministrations of the village blacksmith. If Providence was kind, an itinerant dentist might be in the neighborhood. In any event, the proceedings were much the same. Braced in a wooden rocker, restrained by the sturdy arms of one or more sympathetic neighbors, without benefit of anesthetic, as anesthetics were unknown and unheard of at that time, the dental patient of those days submitted to crude, unsterilized, unclean forceps or a turnkey wielded by the strong hand of an unskilled operator.

Announcer: Was any attempt made to care for the patient or his jaw after the tooth was out?

Dr. Winter: None whatever. Post-operative treatment was unthought of. In time, with luck, nature healed the gaping wound. Seldom, if ever, was an artificial substitute inserted to replace a missing tooth. Only when time and disease wrecked the entire mouth was any effort made to substitute false teeth—and false they were in more respects than one. Honest as your forefather's dentist may have been, sincere as he probably was, he was unschooled, unskilled and unscientific. Tutored in the rough college of experience, taught the crude rudiments of his craft as an apprentice, hired out to his preceptor, your grandfather's dentist was one of approximately a thousand dental practitioners widely scattered up and down the Atlantic seaboard and through the thinly settled territory west of the Alleghenies.

Drawn from the ranks of the artisan, goldsmiths, blacksmiths and barbers, these American dentists of a hundred years or so ago attempted to administer to the dental needs of our forefathers.

Announcer: How was it that the dental profession really came into being?

Dr. Winter: Fortunately for the future of American dentistry, the few really professional members of that time realized that the dental service being rendered was in no ways commensurate with the needs of the American people.

About that time, there developed in the minds of the better men in the profession a recognition of certain primary requisites for the improvement of Ameri-

can dentistry. Some of these prerequisites laid down by our early forefathers were: a greater and wider knowledge of dental subjects; more expert skill in rendering dental service; the exclusion of unqualified, untrained and unethical men from engaging in the practice of dentistry; legal, moral and ethical control over the actions of dentists toward their patients and society, and the development of facilities to disseminate to society dental health knowledge.

Announcer: Well, Doctor, those were serious and weighty obligations to place on the shoulders of an infant profession.

Dr. Winter: They were serious obligations, Mr. Blank. Conceived a hundred years ago and handed down through the years from one generation of dentists to the next, they have stimulated our members to work and strive and battle to convert those obligations into contributions to society.

Announcer: Judging from what little I know about modern dentistry, I should say that you have been eminently successful.

Dr. Winter: Successful, yes, Mr. Blank, but not eminently so. In less than a hundred years, American dentistry has accomplished much, but our goal still lies somewhere in the future. Many of those early visions of our pioneer forefathers have been converted into realities. Less than a hundred years ago, there were no dental colleges in this country—in the world, in fact. In 1840, the first school of dentistry was founded, in Baltimore, Md. It has functioned continuously ever since. Today, there are thirty-eight dental colleges in the United States and three in Canada. The curriculums of those schools are supervised and regulated by a national group of educators, so that the course of study is constantly improving. One hundred years ago—yes, as late as fifty years ago—a young man desiring to enter the practice of dentistry received his training as did other craftsmen, through apprenticeship. He hired out, or attached himself, to a practicing dentist. After a period of observation and training, depending on his aptitude, he established an office for himself. He was expected to fill cavities, extract teeth and perhaps provide substitutes for missing teeth.

One of the greatest contributions that organized dentistry has made to society within the past fifty or sixty years has been the raising of dental requirements and dental standards of service. Today, a young man wishing to enter the dental profession must have graduated from a Class A high school. In addition, he must have one or two years of college work, plus four years of intensive training in a dental school.

Announcer: I suppose the discovery, twenty or thirty years ago, of the fact that dental disease is frequently the cause of certain systemic diseases has been responsible for the improvement in dental curriculums.

Dr. Winter: Undoubtedly. Formerly, a good dentist was a highly skilled craftsman. Today, a good dentist must be not only a skilled craftsman, but also an artist, diagnostician, doctor, surgeon and teacher. The conception of dentistry as a health service has been responsible for closer cooperation between dentists and physicians. Physicians frequently require the dentist's expert advice in diagnosing certain ailments in which the condition of the gums and teeth may be a contributing factor. And dentists no longer treat the mouth as a separate unit, detached and isolated from the rest of the body. They frequently need the advice and assistance of the physician to combat systemic disturbances which have caused the dental disorder.

Announcer: Well, at least one of the

ideals formulated by the founders of American dentistry has been realized. What has been done about the others? For instance, what has organized dentistry done to exclude the unqualified from practicing, and what has been done to control either ethically or legally the actions of dentists toward their patients?

Dr. Winter: Much has been done in that respect, and the American Dental Association is constantly striving for further improvement. One hundred years ago, we had no laws to protect the public from dental quacks and charlatans. It was common practice for many dental craftsmen to advertise their wares by suspending a large golden tooth in their doorway, similar in character to the insignia of the pawnbroker, the tobacconist and the barber. There was no state legislation governing the control of dental practice. In 1841, the first legislation designed to restrict and regulate the practice of dentistry was enacted by the state of Alabama. Today, every state in the Union, thanks to the efforts of our Association, has laws regulating the practice of dentistry. During the last three years, more than thirty states have strengthened and improved their dental practice acts in order better to protect their citizens against unethical and unqualified dental practitioners. Today, a person wishing to practice dentistry must be a graduate of a recognized dental college and, in addition, he must pass a state board examination qualifying him to practice in that particular state.

Thanks to the ideals and the code of honor of our profession, it is undignified and unethical in America for dentists to advertise. In many states, it is unlawful.

Announcer: What about the other developments in the field of dental science, Dr. Winter?

Dr. Winter: Time will not permit me to enumerate all of the contributions made to society by organized dentistry within the past half century. But you might be interested to know that more than twenty years ago, the American Dental Association established a research commission, which works very closely with the U. S. Bureau of Standards. This commission determines the composition of and evaluates materials used in dentistry. It has been of inestimable value in providing the public with dental alloys, gold, cement and other materials of excellent quality.

Several years ago, the American Dental Association made another definite contribution to society by establishing a bureau of chemistry and a council on dental therapeutics. These research bodies analyze all drugs and medicaments used in dentistry, and pass judgment on the therapeutic claims of their manufacturers. This is a safeguard which we have erected to protect society from the manufacturer of worthless and sometimes harmful dental drugs.

Announcer: Those are certainly worthwhile contributions, Doctor—contributions which I, for one, never realized, and therefore never appreciated. Tell me, before closing, what has your profession done to carry out the last of the tenets laid down by your early organizers—what have you done about disseminating knowledge of dentistry and dental health to society?

Dr. Winter: We are developing that phase of our professional field at the present time. We must educate the public regarding the value of preventive dentistry. Dental infection is one of the most prevalent of human diseases. Not only does it affect mouth health and personal appearance, but many times, the general health and efficiency also. Organized dentistry is fully aware of the seriousness of this situation. We know that both the prevalence and the destructiveness of the

disease can be greatly reduced by preventive measures. It is our duty and our obligation to educate the public in matters of preventive dentistry, so that they themselves can detect or prevent dental disease.

When we have attained this ideal, dentists will become, in truth, doctors, or teachers, as the name implies, rather than dental surgeons.

NOTES FROM THE SAN FRANCISCO SESSION

Vincent's Infection and Diet

Hall Best, president of the Australian Dental Association, presented the theory that diet is related to the disease of trench mouth, or Vincent's infection.

A study of 15,000 savages on the Island of Manus in New Guinea by R. M. Kirkpatrick of the University of Sydney produced these results:

In the interior, where the principal diet consists of the taro root and ago leaf, trench mouth is almost universal. This, according to Dr. Best, is due to lack of vitamin C. On the coast, where fish and fruit are the principal foods, the savages are relatively free from the disease.

This proof that an unbalanced diet leads to a higher incidence of trench mouth, and other oral disease, marks an important milestone in preventive dentistry and medicine, Dr. Best declared.

Preventive Care

Raoul H. Blanquie, general chairman of the Local Arrangements Committee, believes that it's cheaper to change the oil than to let the car wear out, and it's cheaper to catch a little cavity than to pull out a tooth. The saving of money, he states is, of course, not the most important benefit of frequent examination, but the fact that the condition of the mouth is an excellent index to the condition of the general health. "There is no health economy in neglect, and from it there is frequently much loss."

Motion Picture Stars Fine Teeth

C. L. Pincus, of San Francisco calls attention to a Hollywood wrinkle in dentistry "all its own." Some Hollywood dentists specialize in making porcelain casts which screen stars fit over their own teeth to give them the appearance of dental perfection for photographing purposes.

These porcelains are, of course, removed when the star leaves the studio. They serve to eliminate the black spaces shown in photographs of teeth that are even slightly crooked.

Value of Dentistry

A dentist has value to every person in a community during all of that person's life, George Wood Clapp stated at the San Francisco Session.

"The dentist begins by safeguarding the expectant mother from infections which might occur in her mouth and endanger both herself and her child. He protects the child, as it grows older, from toothache, too early loss of baby teeth, deformity of the jaws and the constant danger of infection.

"Later, he preserves the good looks which are an asset to every man and woman, and finally, he reduces the frequency and severity of many uncomfortable and painful diseases.

"Truly, a dentist is worth much to a community, in his contributions to its welfare."

The Walter G. Zoller Memorial Dental Clinic*

The following announcement as submitted by the Director, Dr. J. R. Blayney, is printed, verbatim, for the information of our members:

Through the generous gift of the late Walter G. Zoller, the University of Chicago has established a dental clinic for the treatment and study of dental diseases of indigent patients. The clinic is located in Albert Merritt Billings Hospital, which together with the Bobs Roberts Memorial

*Reprinted from The Bulletin of the Chicago Dental Society, July 9, 1936.

Hospital for Children, the Gertrude Dunn Hicks Memorial and the Nancy Adele McElwee Memorial for Orthopedic Surgery, the Max Epstein Clinic, and the Chicago Lying-in Hospital constitutes the group which are located on the University quadrangles. This close association with these outstanding hospitals affords the assurance of ample opportunity to study oral disease thoroughly.

The primary concept in the establishment of the Walter G. Zoller Memorial Dental Clinic by the University is to provide adequate dental service for and to promote the general welfare of the worthy poor through the systematic study of dental disease.

APPOINTMENTS

Appointments will be made from time to time to the positions of internes, fellows, assistants, instructors, etc., on a full time basis. All applicants for these positions are required to have completed a four-year course in a recognized dental school. An applicant for the rank of fellow must have shown some special interest and ability in the study of a dental problem and have completed an interneship in a recognized hospital or have served at least an equal time on the staff of an approved dental or medical school.

All members of the senior staff are on a full-time appointment by the University. Their entire time is devoted to the care of patients, the study of dental problems, and the training of the resident staff. A fellow or an assistant may be assigned to some member of the senior staff to assist him in his clinical work and in the pursuit of some investigative problem.

All appointments as internes are for one year. Appointments for the position of fellow and assistant are made for one year but may be renewed.

COMPENSATION

All members of the resident staff receive full maintenance, including board, room, and laundry, or receive compensation to cover this expense. They provide their own uniforms. Compensation for fellows, assistants, and instructors depends upon their previous experience, the length of service in the University, and the responsibility placed upon the appointee. In requesting information, applicants should submit their qualifications to the Director of the Dental Clinic.

HEALTH SERVICE

All members of the staff participate in the Health Service of the University Clinics. For those appointed without salary, the Clinic contributes to the plan. Those who receive salary contribute one dollar per month. All appointments to the staff are conditioned upon the passing of a satisfactory health examination by the Health Service.

DESCRIPTION OF SERVICES

I. Clinical

The clinical service is limited to the indigent. All applicants for service will be investigated by a competent social service worker before they are admitted. Dental care is given without fee. This will include those procedures commonly known as operative and prosthetic restorations, therapeutic treatments, and minor oral surgery—extractions, cysts, and fractures. Patients will be admitted by appointment with sufficient time allowed the staff to make a thorough study of the conditions and to perform each operation in the best possible manner. Whenever necessary the patient will be given a thorough physical examination in the hospital so as to determine the relation which exists between the general physical condition and the oral lesions. Emphasis is placed upon the complete study of the pathologic conditions in each case and their thorough treatment rather than the volume of clinical work accomplished. Seminars, lectures, and conferences will be held frequently. The staff is invited to attend lectures and addresses given by scientists visiting the University as well as to attend the various dental meetings held in the city.

II. Study and Investigation

This division of activities under the Zoller Foundation is made with the firm con-

viction that the crying need today is not more dental service but a better understanding of what creates the need for this dental service. Imbued with the belief that the greatest good to the largest number of people will come through the combination of clinical service with an orderly program of study and investigation, appointees will be given ample opportunity for study. Those having the rank of fellows, assistants, and instructors will have the privilege of taking advanced work in whatever department in the Biological Division their special interest falls, provided they meet the requirements of the department. All appointees will be expected to select some problem for original investigation. These studies will be carried simultaneously with clinical service.

With these ideals as the premise, the purpose of the Zoller Foundation briefly stated is to offer the best possible dental service to the indigent, to provide an opportunity for advanced training to the recent dental graduate, to improve therapeutic methods for the treatment and control of dental disease, and, finally, to come to a better understanding of the relation which exists between the mouth lesions and systemic disease.

For further information, address the Director, Walter G. Zoller Memorial Dental Clinic, University of Chicago, Chicago, Ill.

New Dental Health Educational Charts*

The Bureau of Public Relations announces a set of eight new dental health educational charts (see page A-32 of the advertising section). Each chart is 22 by 29 inches and is printed on heavy 100-pound paper. The illustrations, which are done in five colors, are both accurate and artistic. Bound at the top with the modern popular spiral binding, these charts furnish an educational unit powerful in theme and pleasing to the eye.

They have been designed for use in the dental office and for high school and normal school students. Each chart consists of one large primary illustration 14 inches square, supplemented by five smaller illustrations, each 4 inches square. The text which accompanies each chart has been reduced to a minimum, yet it is sufficient to furnish educators or the laity with the fundamentals of dental health.

The set covers eight distinct subjects: dental anatomy and histology; the deciduous teeth, their function and dates of eruption; the permanent teeth, their function and dates of eruption; diet and dental health; dental care; home care of the mouth; how and why the deciduous teeth should be cared for, and how and why the permanent teeth should be cared for.

These new charts will be ready for distribution on or about September 15. The price, in the United States, is $1 a set, postpaid.

Order one now for your own office.

Notify your school authorities that your association has available this authentic and graphic dental health educational material, which is suitable for upper elementary and high school pupils and normal students. Turn to page A-32 in the advertising section for illustration and order blank.

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*The Bureau of Public Relations wishes to acknowledge with thanks the assistance rendered in the preparation of these charts by Drs. Kronfeld, Wellman, McNulty, Grisamore and Pendleton, of the Chicago College of Dental Surgery, and Drs. Hoffman, Teuscher and Vehe, of Northwestern University School of Dentistry. The artist is Melville Steinfels, of Chicago.

DENTAL ECONOMICS

RESPONSIBILITY OF GOVERNMENT IN RELATIONSHIP TO DENTAL PRACTICE*

By ARTHUR C. WHERRY, D.D.S., Salt Lake City, Utah

THE basic subject that is before the members of the dental and medical professions and the public at large today is: To what extent should legislative action control the health service of a community? Certain statements regarding this subject have been very misleading. Various groups and agencies not concerned with health service as represented by the professions that render this service, groups and individuals who are interested in finding ways and means to take the health service from the control of the professions and pass it over to representatives of political units, welfare agencies and visionary administrators of foundations, have, in a few years, come to know so much about the subject that they feel themselves better qualified to settle this question and manage the health service than the professions, who have, through the past ages, protected the public, served humanity and made all the progress which the world has known in the art of health.

Of course, differences of opinion arise in the consideration of this subject. And this is a healthy sign. Without honest differences of opinion and judgment, progress would be arrested, ability would be unrecognized and rugged individualism in the realm of the art of health would become an unnecessary characteristic, especially as applied to the practice of one's profession.

The recent economic conditions of the world in general, and our own country in particular, have afforded a fertile field for development of the various isms, and for the ideas of impractical reformers, until it has become possible for the most reckless and ruinous policies to find sponsorship if they give promise of personal advantage and livelihood without the honest sweat of the brow.

Our present national policy, to which the dental profession pledged loyal cooperation and support, a pledge which has been faithfully kept, has been inclined to accept fanciful panaceas and visionary reform plans without serious and sufficient testing and analysis to determine their soundness and workability. In our own profession, we too well know of the viciousness of premature exposition, with publicity for so-called "new discoveries." This topic alone would be sufficient for a sermon or address, but it is beside my subject, except as it serves to illustrate the danger of allowing half-baked ideas and theories to gain recognition and standing before being submitted to the acid test as to their scientific, as well as practical, fitness.

In my opinion, it is the responsibility of the state to protect the public in all

*Read before the Section on Dental Economics at the Seventy-Second Annual Midwinter Clinic of the Chicago Dental Society, Feb. 19, 1936.

phases of health service from the irresponsible, incompetent, designing and grafting who seek to find in the profession a lucrative field for the practice of their chicanery. It is beyond all question the responsibility of the state to maintain a system for ascertaining the competency of all who would seek to practice the healing arts in any of their many ramifications, and this responsibility of the state should be met, without political influence and dictation. There are too many instances of appointments to state boards which were made for the purpose of settling some political indebtedness and paying off party workers, without consideration of the responsibility vested in the state in its licensing power. It is the responsibility of the state, by legislative action, to see that these ingenious subterfuges for the debasing of the healing art by political control are prevented. This, a recognized and admitted responsibility of the state, is mentioned only to pay proper and due respect to it. In my opinion, it is just as much a part of the duty of the state to maintain control of the practitioner after he has proved his ability and been certified as to eligibility as it is to certify as to fitness to assume the responsibility of practicing his art. To possess professional knowledge is not enough. Professional ethics requires men practicing the healing arts to possess knowledge for a purpose, and that purpose is to alleviate the suffering of humanity, to prevent, as far as possible, the degenerative processes of disease. In our profession, we seek, by means of mechanical procedure, as well as technical and artificial agents, to preserve anatomic structure, replace destroyed anatomic parts and render honest, modern and scientific dental service to the patient. Whenever a physician or a dentist fails to render a professional service commensurate with the best of his skill and knowledge, it is and should be the duty and responsibility of the legislature to administer corrective measures, which could be enforced through its policing powers.

These principles are too uniformly accepted by our thinking citizens to need further discussion. But the trend of thought of certain groups and influences during the last few years would tend to carry our government into the economic supervisory control of the practice of our professions. Because I am positive that this is not the province of legislation, I have been asked to give my reasons for the position which I assume in opposing the government, be it national or state, in any paternalistic regimented control of the men of our profession and the service that they render the public.

It is unfortunate that the consideration of this important issue has been allowed to become so controversial. It is unfortunate that outside groups and influences have been allowed to project themselves into a self-appointed, autocratic sponsorship of a program for the control of health service without first finding a plan that would be acceptable to the medical and dental professions. Nevertheless, I am not discouraged because I am convinced that there is sufficient wisdom and judgment in the leadership of American groups and organizations to recruit and muster an army of loyal citizens who will become the vigilantes of the present and check the radical inroads. When the smoke of battle is cleared away, no political party, no group nor any individual will have sufficient power to dictate policies that are destructive to our constitutional existence.

During my year as President of the American Dental Association, in season and out of season, I insisted that our profession should maintain an attitude of loyalty and should generously cooperate

with the government in its various policies for the control of health problems, yet I steadfastly, with all the force and power at my command, insisted that there should be no attempt on the part of governmental agencies to take the control of the health service away from the medical and dental professions. I opposed the radical demands of some of the hasty groups in our own profession, who would have led us into complicated so-called reforms in their groping to do something to change the setup regarding health service. A period of distress, dominated by hysteria and propagandized by visionaries, is no time for the establishment of even a worthwhile policy, which, when adopted, should have been sufficiently tested to be lasting.

So generally recognized an authority on economics as Senator Glass is entitled to more than passing recognition for his judgment, and his statements, so frequently quoted in the daily press during the depths of the depression, prove the soundness of the policy which our profession adopted unanimously (as far as official action was concerned) opposing any program so far advanced in this country of ours for a so-called reform of the practice of health service as now administered by the members of the medical and dental professions.

I said that as far as official action had been taken, we had been unanimous, and I give recognition to the fact that certain distinguished men of our profession have differed with this policy, but I believe it must be the work of a Being who wisely controls the destiny of our universe that their convictions have not been permitted to have more influence on our professional position.

It is, in my opinion, most unfortunate that so extensive a program of propaganda has been carried on by agencies outside the profession that have represented large foundations. If these representatives of various foundation funds had, with sincerity of purpose, been able to find a compulsory health insurance program anywhere in the world that has worked successfully and satisfactorily for the welfare of the people and for the advancement of the medical and dental sciences, they would have been able to sell their ideas to the American Dental and American Medical associations. I resent and challenge the sincerity of any group which seeks to malign and cast reflection on the honesty of purpose, the sincerity of intent and the conscientious desire of the leaders of these national organizations. Though it is true that the men of these professions may not be so successful in business matters as they might or should be, the record of our achievements through the past hundred years and the progress that has been made in the field of healing art by their conscientious devotion to the welfare of the people has led to a preeminent position throughout the world for these two professions. And when men of our profession seek to follow these outsiders who malign and viciously attempt to discredit the integrity of the leaders of our two professions, it is, in my opinion, time for the members of these professions not only to resent it but also to denounce it. In speaking before the American College of Dentists at St. Paul, I declared that there can be but one voice to speak for organized dentistry, and that is the voice of the American Dental Association, through its lawfully constituted authorities as directed by the House of Delegates, representing the forty-eight sovereign states of the United States. When any administration, any group of political autocrats or any visionary so-called reformers representing foundations controlling large sums of money set themselves up to deny to the representatives of our profession this

right, it is time for us to speak out without fear and with all the force at our command.

In his address at the Annual Session of our organization at New Orleans, the President, Frank M. Casto, made the following statement:

> The argument advanced in favor of compulsory health insurance is based primarily and perhaps necessarily upon the experience of European countries. The profession has realized, however, that no scheme can be defended by merely saying that the British, Germans or other foreign countries have it. The economic conditions with which we have to deal are in a large measure peculiar to our own country—its history, habits, circumstances and traditions, and we know that it would be unwise to imitate devices adopted by other countries without reference to our own national characteristics. . . .
>
> There is a wide difference between a health insurance plan administered and supervised by the profession, the payment for which is voluntarily made by the recipients of the health service; and a compulsory health insurance scheme administered and supervised by the Government for which the recipients of service are compelled to pay certain definite sums out of their wages into an insurance fund.

Dr. Casto presented two important points to which the membership of our profession should give most thorough consideration. The first is the fact that the investigators and sponsors of these various agencies who have so influenced certain members of our profession are advocating the transplanting of a so-called reform program into our country that would imitate the European plans, without a proper consideration of the differences in our American body politic, our national traditions and conscience and the home life of our citizens. These sponsors are also failing to evaluate and appreciate the difference that prevails in the standards of American life and customs, and it would be their idea that American life and customs should be made to adapt themselves to their program and scheme. They have written books and flooded the air, lectured and preached statistics, which they have compiled from the various governmental agencies of Europe relative to the workings of these various systems. Too much of the discussion that has beclouded our atmosphere has been founded on erratic and distorted tabulations of statistics from the political and lay dictators of the particular system which was being reviewed. Not enough of the facts and findings have been based on opinions of the public, who have to pay the bill through the system of extracting from their pay checks a portion of the funds for carrying on the system.

Not until I accompanied Drs. Casto and Winter to Europe for the purpose of making a first-hand study of this question did I have opportunity to know the true attitude of the citizen who pays "the freight" and is the recipient of the low standard of dentistry. As a result of this first-hand study, I can say to you that I had opportunity to make contact with people of all strata of society, from a member of the finance board of France, which is a position similar to membership on the Federal Reserve Board in the United States, and the President of Free Ireland, past president of the Dental Supply Dealers of the British Empire, officers of labor unions, employers of large groups and representatives in general who control industries and finance institutions, to the lowly specimens of human life in the poverty stricken sections and slums, living in such places and under such conditions as I would never have imagined could exist. If I should right now describe to you some of the places that Dr. Casto led me into in order to add to the information which we had, in an honest effort to arrive at a proper appraisal of the situation, you

simply could not enjoy your next meal.

As a member of the Rotary Club, having maintained a record of 100 per cent attendance for many years, I found Rotary Club meetings in the cities we visited in Europe very interesting. There I made contact with dentist members, who, in most cases, were natives of the particular country which we were visiting, and I found also representatives of labor unions and systems administering insurance funds. I found too, in those meetings, men who were willing to accept me without hesitation or doubt, and I was able to get at first-hand the reaction of those on each side of this controversial question, from men who were the victims of the systems to those who were administering the system as representatives of labor unions and organizations representing the poor people whose funds were being administered.

I do not review these facts for the purpose of picturing the distress and poverty of European countries, but for the very much more important purpose of calling attention to the fact that if there is a place on the face of the earth in which a workable, practical plan should be evolved to care for the needy and neglected, it is the European countries which we visited. And I can very readily see how, with the extremes of dental neglect that prevail in those countries, any one would be willing to seek some program that would tend to improve and correct conditions. The terrible and tragic feature of this whole issue is the fact that the system has not accomplished the sought-for results in any of those countries, and the deplorable and degenerative influence on dental practice and progress has become an unthought of and exorbitant price to pay for a false and vicious reform system. I say "false" because the results and practices have proved it so; and I say "vicious" because of the practices that have been allowed to develop for the control and dispensing of the funds collected, because of misdirected political control and employment of so many political appointees, who dictate to the poor who have supplied the funds and to the down-trodden representatives of the dental profession who are attempting to render the service. Truly, there has been a vicious debauchery of what was represented to be a social evolution. As a result of these European plans and systems, European medical science has fallen from its preeminent position and has suffered in practice and progress and standards. Some will question the authenticity of such statements, and will say that private practice has not suffered in Europe and that many of the outstanding men of the professions of medicine and dentistry continue undisturbed by the inroads of these various systems.

We visited for three days with the representatives of the dental profession in attendance at the London meeting of the American Dental Society of Europe, and we sought from them information as to this system. Without exception, we were told that it had resulted in a lowering of professional standards, a discrediting of the prevailing standards of remuneration for worth-while service to such an extent that it was most disheartening. I have a few statements, which I will not take time to read, from Americans of distinction in our profession who were willing to give us their opinions on this whole question. They established a contact for us with British dentists who represented the profession and were largely instrumental in having certain reform measures included in the British law and practice. We made contact with laboratory representatives to ascertain as nearly as possible the class of work being done for the profession today as compared with a few years ago. We interviewed the supply

dealers to ascertain the quality of dental supplies being purchased. We went into the offices of private practitioners—men who are practicing both private and panel dentistry and men largely dependent on insurance practice. If I were to state the facts as we found them on this apparently endless pilgrimage into antiquated offices, I would be accused of slandering European professional men; but I do feel that it is the right of the men of our profession in this country, the United States of America, to know just how degenerative these influences are that they may be forewarned of the inevitable consequences of any favorable attitude toward this most questionable scheme.

This question is being debated extensively in all parts of our country, in our junior colleges and in our high schools, and it is the duty of our profession to see that sufficient material is available setting forth the true status of this whole matter—not for the protection of the profession (God forbid that I should be narrow enough to place that interpretation on the subject), but for the protection of the public, who would be misled and abused if a system should ever be imposed on this country with results similar to those we found in various European countries.

In the informal discussion that will follow the formal presentation of this subject, I will be glad to detail my impressions and read extracts from statements, but to insure their being of the greatest possible value, they must of necessity remain "off the record." I have no desire to make my discussion offensive to people of other nationalities who are doing the very best they can under the conditions imposed upon them—and why should I? As an American citizen, one who has been honored by my profession far beyond my fondest ambitions or hopes, I feel simply that I have a duty to perform. In coming to you with this message, I do it not in a spirit of controversy, not for the purpose of assuming the know-it-all attitude, nor for the purpose of casting a reflection on those with whom I must differ, but solely as a responsibility to my country, which has given me the most nearly ideal opportunity for life, liberty and the pursuit of happiness that is accorded to any person any place in the world. With this word of explanation of the spirit which prompts me to make my report, I give you these findings:

In discussing the insurance dentistry question and referring to the various European systems, by whatever name they may be designated in any particular country, I want to be distinctly understood as in no way referring to the men confining themselves to private practice exclusively, or limiting themselves to a small percentage of panel or insurance practice. These men have, with noble purpose and determined will, striven to combat the degenerative effects of insurance regulations and diminishing fees resulting from this unfair and unethical system. Theirs has been an uphill fight in the face of impossible odds, with handicaps that have been enough to dishearten more courageous and stalwart men. They are worthy of our highest commendation and merit our everlasting gratitude.

I implore you in considering my discussion of this subject as it applies to insurance practice to understand that it is the system that has betrayed the men and broken down their standards, owing to their necessity and the insurmountable requirements established by lay dictation, political greed and governmental interference with professional service.

In our study of compulsory health insurance as it applies to the practice of dentistry, in the various European countries we visited, we found some startling

conditions, and I might state in passing that this applies to our investigations in France, Belgium, Holland, England, Wales, Scotland, North Ireland and Free Ireland. The name of the system varies, but the results are almost uniformly the same. While we investigated this subject primarily from the standpoint of the dentist and interviewed practicing dentists of the higher strata, the middle class and the poorer licensed practitioners, we were forced to carry our investigation into the industrial groups. We visited clinics of mercantile establishments, the operators of street car and railroad systems, taxicab drivers and hotel porters, and in every country we went into the slum sections and made direct contact with the unfortunate. Briefly, we found in each and every country evidence that compulsory health insurance, as it applies to the practice of dentistry, fails to protect humanity with any reasonable dental health program of preventive dentistry. It utterly fails to develop dental practice with a reasonable program for restorative, operative dentistry, such as the modern dentistry of the United States requires the dental operator to render. It was very evident that, under these various systems, there is not even a reasonable amount of effort in the field of scientific diagnosis for the purpose of safeguarding the health and happiness of the human family, procedures that are commonplace and used daily in every modern dental office in the United States.

The value of the roentgen-rays is almost totally ignored in the various compulsory health systems of Europe. There is no effort made for the conservation of extensively decayed teeth: they are condemned to the forceps. There is no attempt made to practice modern orthodontia, the science of correcting the malposition of teeth in the human jaw; and so the victims of this distressing and unsightly condition are forced to accept extraction as the only remedy and the substitution of hideous false teeth. This modern socialized system that we have heard so much about makes no attempt to utilize the modern mechanical appliances so generally used in America for attaching partial prostheses to the remaining good teeth by means of clasps and bars, as this is a modern science and unknown to the European system. There is a total absence of effort to maintain the normal physical facial features and thus preserve the normal personal appearance.

These various systems do not allow the dentists to exercise individual discretion and judgment in deciding what dental work is needed. Lay supervisors are the absolute dictators as to when people are entitled to dental service, and it might be stated in passing that those in need of care must have had their pay check drawn on for at least five years in order to be eligible to receive dental service. This long-time requirement affords opportunity for the complete destruction of the masticating machine before the individual is eligible to any aid from the insurance fund. It is this deplorable inconsistency that has led to the expression common in Europe among dental practitioners: "blood and vulcanite dentistry," meaning extraction of teeth and substitution of the poorest and cheapest type of substitute in the form of rubber plates.

The last, but not least, surprising result of our study and investigation was the fact that no one of these systems has provided any kind of a program for dental service for the indigent. This was an amazing feature of these various programs, as we had always understood that care of the indigent was the ideal of these various systems, that one of the important purposes of these various systems was a program that would provide dentistry for the poor and unfortunate who could

not provide for themselves. In reality, we found, in the European countries visited, that the poor and unfortunate derive no consideration of benefit from this whole nefarious system, only the people of the low income class being covered. They have a certain percentage deducted from their pay checks and set aside to build up a fund for health service. In passing, it is worth while to state that a very large proportion of this fund in every country goes to lay administrators and supervisory officials politically appointed, incompetent to administer and interested only in drawing their regular salaries. This total neglect of the indigent is the most surprising failure of the whole system, and one that American enthusiasts who are urging socialized health service should be made to understand.

All of these systems definitely and positively lead to a lowering of dental standards in all classes of dental practice because of the impoverishing influence of the lower fee and the necessity for the use of inferior dental materials. It is impracticable and impossible for a dentist to maintain two standards of dental work, one for the compulsory health insurance patient and the other for private practice, and the patient is prohibited in most countries from paying the dentist an additional fee in order to secure a better class of service. In such countries, the dentist loses his status as an approved practitioner if he accepts additional fees from the patient direct or does any dental service that has not been approved by the lay supervisor or administrator.

Consequently, the incompetent, unscrupulous and mercenary practitioner profits by these various health insurance systems; while the sincere, competent and worthy skilled practitioner is handicapped and sacrificed to the degenerative processes of graft and incompetency.

If we condemn what others have offered as a solution to our social ills, we must offer something practical that will afford ways and means to provide a system that will supply dental service for a larger percentage of the human family. On that point, we are all agreed. Our program proposes to offer such a plan.

It must be one that provides for the maintenance of individual responsibility and the promotion of personal self-esteem. Character and will power are developed only by rugged individual effort. Our dental program must perpetuate the American superior service. It must safeguard the personal relationship —yes, sacred relationship—between patient and dentist, without any lay dictator or political appointee indicating what is to be done or who can do it.

The patient must be allowed to maintain his pride and self-esteem. He must be encouraged by a sound, sympathetic economic set-up that provides financial underwriting, be it for large or small needs, that will make salesmanship of dental health service competitive with the luxuries and nonessentials of the everyday life of American citizenry of the low bracket class. This must be provided without excessive loading and embarrassing red tape.

By these last statements, I wish to be distinctly understood as placing myself on record not as an obstructionist and nonprogressive conformist, but as one who recognizes the need for progress. I do, without hesitation or reservation, make the assertion that our professional practices have been too impractical and have in a large degree lacked sound economic consideration. When a nation like ours, through its citizenry, can build up a moving picture industry such as it has built up in twenty-five years and which all classes of people patronize, and can build up an automobile industry such as has been developed during the past thirty

years, the automobile now being universally considered a necessity, along with other nonessentials from a health standpoint and with luxuries which are commonplace in the average American life, I believe that our profession has been backward in selling itself to the public.

We have not established our business principles on a sufficiently elastic plane to compete with the more progressive business practices of the industries supplying luxuries and nonessentials, and, in my opinion, there is no greater responsibility resting upon organized dentistry today than to find the answer to this all-important subject.

This is difficult, as many people dread dental work so genuinely that they neglect themselves and their families even when they have plenty of money to buy anything they wish. Therefore, I do not wish to be understood as placing all the responsibility on this phase of the subject. I do believe that our organized group must cooperate with worth while, worthy people who desire and seek dental service for themselves and their families, in establishing a system of financing that will make this practical and appreciated.

But this must be done on a sound basis, one that will not undermine the superstructure of dental science and dental skill, one that will not cause disintegrative practices to destroy initiative and personal resourcefulness. It must be a program of true progress founded upon a policy that will appeal to the manhood and womanhood in the unfortunates who have been neglecting themselves more than they have been neglected. Incentive and initiative are too often lacking. Too many persons shirk responsibility and are looking for something to carry them through the "rapids" and into a haven of rest without effort and without price on their own part.

When I visited Los Angeles at the time of the Southern California meeting, when I was President of the American Dental Association, I was approached by Dr. Townsend, the founder of the Townsend Plan, and his was just another instance of the many impractical and visionary dreams that were presented to me as representative of the dental profession during that year. Dr. Townsend believed that dental practitioners should get behind him because dentists are prone to buy worthless mining stocks and squander their money in unsound gambles, and he tried to picture to me what a panacea for the dentist his plan would be and he reiterated that, in a spirit of self-protection, we should get behind him and help to put over his plan. At that time, I told the venerable doctor that I would hang my head in shame if I sponsored any move by the membership of the dental profession intended to break down their individual resourcefulness, destroy their own initiative and inspire them to fall into indolent practices and reckless extravagance because the Townsend Plan would take care of them in their old age, even at the expense of our national life and the ruination of our American customs.

I have cited this as one of the final points of my discussion for the purpose of illustrating that the trend of the times is not to solve our problems by industry and level-headedness and hard work, but by a search for the end of the rainbow and the pot of gold that the fairy tale has always held out as an alluring possibility.

THE COMMITTEE ON ECONOMICS NEEDS FACTS

The Committee on Dental Economics needs facts and figures on the practice of dentistry. There are a number of methods by which this information can be obtained, most of which are extremely costly and time consuming. After considerable deliberation, the committee has chosen this simple, direct and inexpensive method. The success of the venture will depend entirely on your cooperation. Help the Association, help the committee and help yourself by filling out the form below and returning it in a blank envelop *now.*

This information is important in substantiating claims and making comparisons. It will be the exclusive property of the American Dental Association. *You will not be identified in any way.*

MAIL PROMPTLY TO THE SECRETARY, COMMITTEE ON ECONOMICS, AMERICAN DENTAL ASSOCIATION, 212 EAST SUPERIOR STREET, CHICAGO, ILLINOIS

Number of years in practice of dentistry_____ Age_____

In general practice_____ or specialized in_____

Gross income from practice in 1935 $_____ 1932 $_____

Total office expenses in 1935 $_____ 1932 $_____

Office rent 1935 $_____ 1932 $_____

Office assistant's salary 1935 $_____ 1932 $_____

Net income from practice 1935 $_____ 1932 $_____

Loss from bad credits 1935 $_____ % 1932_____ %

The present value of my strictly dental equipment is approximately $_____

The area in which I practice is largely, agricultural, commercial, manufacturing, residential. (Underline)

Population of town in which I practice_____

Name of state_____ Number of dependents_____

DO NOT SIGN

DENTAL SURVEY OF SCHOOL CHILDREN*

The U. S. Public Health Service has recently released Bulletin 226, which contains all the statistics from the survey of school children conducted through the cooperation of the American Dental Association and the U. S. Health Service in 1933-1934.

At the Seventy-Fifth Annual Session of the American Dental Association, held in Chicago in 1933, a resolution was passed which resulted in a dental survey of elementary school children. The United States Public Health Service, having agreed to conduct this survey in cooperation with the committee for dental health survey of the American Dental Association, prepared an examination form, of which approximately 4,000,000 copies were distributed among state and local dental societies that had indicated willingness to participate in the nation-wide survey. The completed examinations returned to the United States Public Health Service represented a total of twenty-six states.

The 1,438,318 examined children in the twenty-six states are classified according to color, sex and age. Also, the percentage of the estimated population of the ages of 6 to 14 years is shown by counties. This is the first time that any comprehensive effort has been made to secure definite data regarding the dental conditions of American children as a whole. The tabulations comprise a summary of the oral observations made in various parts of the country by approximately 8,000 practicing dentists of varied training and experience; and although these observations were influenced by personal opinion and by the conditions under which the examinations were made, it is believed that the tabulations give an approximation of the oral conditions of a large cross-section of the elementary school population of the United States and that a comparison of observations from a particular area in respect to color, sex or age probably yields a suggestion of the influence of these factors on oral conditions.

Every dentist who participated in this survey will want a copy of Public Health Bulletin 226. It may be secured from the Superintendent of Documents, Washington, D. C., for 20 cents.

The Committee on Dental Economics, American Dental Association, 212 E. Superior St., Chicago, has a limited number of the bulletins on hand, which it can supply for the same price.

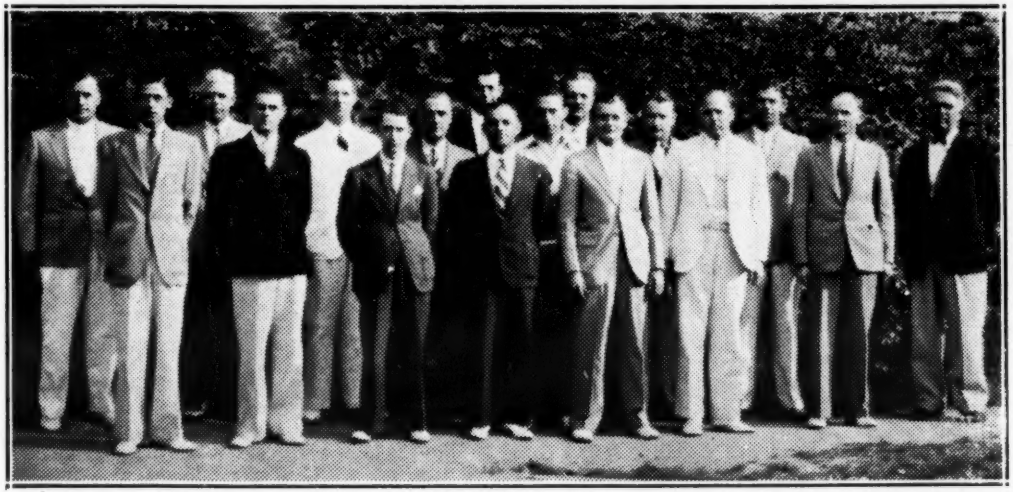
A COURSE IN PUBLIC HEALTH DENTISTRY

The University of North Carolina is the first university to present a course in public health work for dentists. The accompanying illustration pictures the first class to take the course, which was given during May and June of this year. These men are all members of the dental staff of the Division of Oral Hygiene of the North Carolina State Board of Health. The next twelve weeks' session is scheduled to begin in September. M. J. Rosenau is the director of the Division of Public Health of the North Carolina Medical School. E. A. Branch, director of the Division of Oral Hygiene of the North Carolina State Department of Health, will supervise all field work. The curriculum will consist of both intramural and field work.

I. The dentists will be required to take and pass examinations in the following courses:

Nutrition
Child psychology
Methods of teaching
Visual education
Public speaking
Cummunicable diseases

*Public Health Bulletin 226.



Dental staff of Division of Oral Hygiene, N. C. State Board of Health, in training in School of Public Health, University of North Carolina.

Reading from left to right: A. J. Pringle, C. W. Stevens, D. W. Dudley, Gates McKaughan, W. I. Farrell, C. J. Goodwin, J. M. Cheek, W. L. Woodard, A. H. Cash, Robert Byrd, A. D. Underwood, Carl N. Moore, A. C. Early, Robert Masten, H. E. Butler, L. E. Buie and Ernest A. Branch, director.

II. The dentists will attend the lectures, but will not be required to take examinations in the following courses offered to health officer trainees:

101. Public health administration
Epidemiology
Child hygiene
111. The principles and practice of sanitation.
141. Vital statistics.
151. Public health laboratory methods.
161. Preventive medicine and hygiene.

III. In addition to the intramural instruction outlined above, the dentists taking the course will be required to make school inspections and teach mouth health in the schools under proper supervision and direction. The field training will be the equivalent of four weeks.

From health surveys in the schools of North Carolina, it has been found that undernourishment is one of the greatest problems and is reflected in the development of the children's teeth. The dentist plays an important rôle in this field and can speak with authority provided he understands the nutritional aspects of the problem.

The school dentist comes in contact with children during the impressionable age and, with proper training, should prove to be invaluable in popularizing, and demonstrating the significance and the value of the movement for better health servants for better health service. If his message is to be educationally sound, he must know modern methods of teaching; if it is to be properly understood by the children, he will need to know how to use all possible methods of visualizing the subject of health. It is necessary that the dentist have a working knowledge of child psychology. If the talks are to be well presented and the valuable time of the school well accounted for, he must understand some of the fundamentals of public speaking.

The tuition for this specialized course for dentists in the Division of Public Health will necessarily be determined by the number of applicants for such training. As soon as this information is available, a reasonable charge for tuition and fees will be announced.

Since necessary arrangements cannot be completed until the number of applicants is known, applications should be sent to Dr. Charles S. Mangum, Dean, School of Medicine, University of North Carolina, Chapel Hill, N. C.

DENTURES BY MAIL

The following communication has just been received from Frederick G. Campbell, Clerk of the U. S. Circuit Court of Appeals for the Seventh Circuit:

FEDERAL TRADE COMMISSION, Petitioner

5709

v.

BENJAMIN D. RITHOLZ, Respondent

The Federal Trade Commission, petitioner herein, having filed with this court on, to wit, December 16, 1935, its application for the enforcement of an order to cease and desist issued by it against the respondent under date of November 20, 1934, under the provisions of Section 5 of an act of Congress approved September 26, 1914, entitled "An Act to Create a Federal Trade Commission, to Define its Powers and Duties, and for Other Purposes" (38 Stat. 719, 15 U.S.C.A., Sec. 45); and said petitioner, having also certified and filed herein, as required by law, a transcript of the entire record in the proceedings lately, pending before it, in which said order to cease and desist was entered, including all the testimony taken and the report of said petitioner; and respondent having subsequently filed his answer, brief, and argument; and the Commission having filed its brief, and the matter having been heard before this court on oral argument . . .

Now, therefore, it is hereby ordered, adjudged, and decreed that said order to cease and desist, issued by the Federal Trade Commission, petitioner herein, under date of November 20, 1934, be and the same hereby is affirmed.

And it is hereby further ordered, adjudged, and decreed that the respondents, Benjamin D. Ritholz, his agent, associates, employees and representatives in connection with the advertising, offering for sale or sale in interstate commerce, and in the District of Columbia, of dental plates, cease and desist from representing in any manner, including by or through the use of testimonials or endorsements or guarantees or in or through newspapers, magazines, radio, circulars, pamphlets, photographs or pictures, letters or otherwise:

(1) that said dental plates are of a value greater than their actual value;

(2) that respondent can make or does make a properly fitting and satisfactory dental plate from an impression of the mouth taken by a layman for whose use such plate is intended;

(3) that properly fitting and satisfactory dental plates can be made from an impression of the mouth taken by one who is not a dentist;

(4) that respondent has adopted and/or is using in the manufacture of dental plates the same scientific methods used by dentists or that he is using scientific methods in the making of said dental plates;

(5) that his methods of making dental plates from self-taken impressions are scientific;

(6) that the dental plates manufactured and sold by respondent meet the customers' needs;

(7) that through written guarantees or otherwise he will refund the money paid for dental plates which are returned as unsatisfactory, when he does not in all cases do so promptly;

(8) that great care or superior workmanship or fine quality of materials are used in the construction of respondent's dental plates;

(9) that dentists have endorsed or approved respondent's methods of making dental plates from self-taken impressions or that they have endorsed or approved any of his methods in making dental plates;

(10) that the laboratory wherein said dental plates are made is personally or otherwise supervised by licensed or other doctors of dental surgery;

(11) that the said dental plates will give full power of mastication, restore the natural facial expression, or enable the purchaser thereof to wear the same with ease and comfort;

(12) that the business of respondent in manufacturing and selling dental plates is conducted by a corporation.

It is further ordered that respondent shall, within sixty (60) days after service upon him of this decree, file with the Federal Trade Commission a report in writing, setting forth in detail the manner and form in which he has complied with this decree.

CURRENT LITERATURE

Pathologic Study of "So-Called" Dental Tumors (C. G. Darlington and L. L. Lefkowitz, Am. J. Clin. Path., 6:330 [July] 1936): The so-called dental tumors are usually symptomless and, in many instances, they represent inflammatory hyperplasia rather than true tumors. The epulis may be peripheral, an alveolar border growth, or central, a growth within the bone. The former represents inflammatory hyperplasia of connective tissue; the latter, an osteitis fibrosa cystica. The cysts may be classified as radicular or dental root, mucous or salivary gland, follicular or dentigerous, and nasopalatine cysts. The first two types usually show evidence of infection, while the latter two do not. These oral cysts are, for the most part, a simple epidermoid type. The adamantinomas, which are not so infrequent as usually is inferred, are true tumors and essentially similar and analogous to the basal tumors. Among the malignant neoplasms, true and low-grade sarcoma, lymphosarcoma, salivary gland and squamous cell carcinoma and malignant melanoma are considered. The low grade sarcoma, a fibrosarcoma, grows slowly, invades, destroys and tends to recur; the salivary gland carcinoma resembles the mixed tumor, but can be histologically differentiated, and occurs at an earlier age; the epidermoid carcinoma often shows a history of chronic irritation. Malignancies in the mouth tend to extend and metastasize locally rather than show remote metastases. The bone tumors are difficult to differentiate from areas of dystrophy and inflammation, are usually benign and symptomless and occur in older persons. Many so-called fibromas represent inflammatory hyperplasia and, in many instances, odontomas are the result of hyperplasia or dystrophia. Polyps may recur after removal as a result of persistence of the irritation that was an etiologic factor. Papillomas are not common in the mouth. In addition to these tumors, the authors discuss mixed tumors, angiectatic tumors and miscellaneous granulomas.

HAMILTON ROBINSON.

Acute Staphylococcus Osteomyelitis. Use of Staphylococcus Antitoxin as Aid to Management of Toxemia and Staphylococcemia (A. L. Joyner and D. T. Smith, Surg. Gynec., & Obst., 63:1 [July] 1936): Encouraging results have been obtained with antitoxin treatment in a total of more than 100 patients by Panton, Valentine, Dix, Gross, Parish, Clark, Dolman; Keith and others. The largest and best controlled series of cases was reported by Dolman. The authors have done extensive work with antitoxins in experimental animals. They review some of their clinical cases, which are very interesting. Their conclusions are: 1. Staphylococcus antitoxin will neutralize *in vivo* the exotoxins of heterogeneous strains of staphylococci. 2. The ratio of segmented to the nonsegmented polymorphonuclear leukocytes is an indication of the severity of the toxemia and a convenient guide to the dose of antitoxin and frequency of administration. In sixteen cases of acute osteomyelitis and staphylococcemia treated by prompt drainage and multiple blood transfusions, there were eight deaths and eight recoveries. In thirteen cases of the same type of infection treated by the same method supplemented by the administration of staphylococcus antitoxin, there were two deaths and eleven recoveries.

J. FRANK HALL.

Procedure for Determining Isoantigens in Saliva (G. A. Matson and E. O. Brady, J. Immunol., 30:445 [June] 1936): Determinations of blood groups by the use of saliva supported earlier reports, which claimed that the antigens of various blood groups were not demonstrable in the saliva

of all persons. When the antigens were present, they were contained in the secretion itself and not in adventitious cells or blood. The occasional absence of antigens is apparently the result, in part, of group ferments.

B. G. Bibby.

Probable Causes of Nonunion of Fractures (H. Turner, J. Bone & Joint Surg., 18:581 [July] 1936): Acute bone decalcification is an essential part of the biologic process, which, in the case of fracture, leads to bone union. This temporary rarefaction is reflex and proceeds from traumatic irritation of the nerve branches that supply the bone and its periosteum. When the irritation subsides, this process is brought to a standstill and is replaced by the deposition of lime salts in the newly formed soft callus and the decalcified ends of the fragments. A soldering-like union of the fragments is thus obtained. In some cases, this irritation of the nerve branches may continue for a long period and prevent nature from carrying out the normal healing process. Local deficiency of lime salts may also cause delay in bone union and may even prevent consolidation. The condition may be a result of the unusual involvement of the sensitive nerve branches, due to trauma, or to the method of treatment, which may tend to maintain the irritation of afferent nerve conductors. In the clinical examination, in such cases, more attention should be paid to the possible involvement of the peripheral nerve branches. Roentgen-ray examination should not be limited to the immediate site of injury. Decalcification at a distant point should be regarded as positive proof of existing traumatic neuritis.

J. Frank Hall.

New, One Minute Method for Staining Spirochetes, Spirilla, Spermatozoa and Related Organisms (A. J. Gelarie, J. Lab. & Clin. Med., 21:1065 [July] 1936): Because of the difficulty, for the general practitioner and casual laboratory worker, associated with the dark-field method, and the unsatisfactory results with Burri's India ink and other available methods for staining spirochetes, the author developed the following technic. Five solutions are prepared: (1) fixing solution, 2.5 gm. of recrystallized zirconyl chloride dissolved in 100 c.c. of 10 per cent sodium chloride solution; (2) citric acid solution, 10 per cent solution of recrystallized citric acid in distilled water; (3) staining solution, 0.25 gm. gentian violet in 100 c.c. of tenth normal sodium lactate solution; (4) solution of K_2 Hg I_4 (0.5 gm. of mercuric oxide in 100 c.c. of 0.5 per cent potassium iodide solution); (5) counterstain, 0.2 gm. of methylene blue in 100 c.c. of distilled water plus 0.2 gm. of phenol. The material is smeared, dried in air, covered with fixing solution for 5 seconds, washed in water, covered with a few drops of citric acid solution for ten seconds, washed, covered with staining solution for thirty seconds, washed, momentarily covered with a few drops of the complex iodide solution, washed, counterstained for five seconds and dried. The organisms stain a deep blue-purple.

Hamilton Robinson.

Manifestations of Leukemia Encountered in Otolaryngologic and Stomatologic Practice (Andrew A. Love, Arch. Otolaryngol., 23:173 [Feb.] 1935): It is a notable fact that in otolaryngologic and in stomatologic practice, leukemic lesions are frequently not recognized as such or their possible significance is entirely overlooked. The first symptoms of acute leukemia are the presence of necrotic lesions on the inside of the cheek, enlargement and ulceration of the tonsils, bleeding of the gingival tissues, acute stomatitis, epistaxis and rapidly developing cervical adenopathy. In cases of chronic leukemia, the patient may have enlargement of the spleen or liver, dyspnea, weakness, loss of weight and appetite, and moderate fever. Often these initial symptoms are overlooked until the patient comes in for a minor surgical operation, such as tooth extraction; at which time, prolonged hemorrhage will be noted. Ordway and Gorham give four outstanding symptoms by which a disease condition of the blood may be diagnosed: (1) anemia, (2) enlargement of lymph glands or spleen, (3) hemorrhage into the tissues or from the mucous surfaces

and (4) throat lesions. The author reviews twenty-five cases, showing blood dyscrasia as it manifests itself in the (1) ear, (2) nose, (3) oral cavity and (4) throat.

J. FRANK HALL.

Lung Abscess (H. C. Lueth and D. C. Sutton, J. Lab. and Clin. Med., 21:1056 [July] 1936): In a study of 101 cases of lung abscess, in which etiology, location, physical signs and diagnostic features were considered, upper respiratory infection was found to be a predisposing factor in 30 per cent and pneumonia in 13 per cent. In eleven instances, operations about the mouth and throat preceded the abscess. Two and one half months elapsed almost uniformly between operation and onset of profuse expectoration. This symptom, expectoration, was the most common and significant complaint, with pain in the chest, loss of weight and strength, and fever also common signs. In patients complaining of pain in the chest and expectoration a few weeks after an acute upper respiratory infection or an operation about the nose or mouth, a lung abscess should be suspected.

HAMILTON ROBINSON.

Influence of Diet on Caries in Children's Teeth (Committee for Investigation of Dental Disease, Special Report 211, of the Medical Research Council, pp. 1-135, 1936): Investigations were carried out to test the effect on the initiation and spread of dental caries of adding fat-soluble vitamins to the basic diet of children living in institutions. In control groups, additions of olive oil and treacle were made. In all, 1,600 children were dealt with, but, for various reasons, final results were not obtained from all. The results are given in detail and subjected to statistical analysis. In the first part of the investigation, it was found that there was no significant difference in the caries incidence in the original permanent teeth of the groups that received cod liver oil and treacle. In the newly erupted permanent teeth, there was definitely less caries in the cod liver oil group. In both the original and newly erupted permanent teeth, there was less caries in the cod liver than the olive oil groups. The difference was more marked in the newly erupted teeth. In the second part of the investigation, it was shown that, in the permanent teeth, there was significantly less caries in the children receiving vitamin D (irradiated ergosterol) than in those receiving olive oil. In newly erupted teeth, the same difference was noted. The original permanent teeth fared the same on additions of treacle and olive oil, but there was less caries in the newly erupted and deciduous teeth when olive oil was used. In the third part of the investigation, it was demonstrated that the structure of deciduous teeth was somewhat improved when vitamin D was added to the diet, and that the incidence and spread of caries were less when vitamin D or cod liver oil was added as compared with additions of treacle. It was concluded "that a relatively high vitamin D content of the food can do much to diminish the incidence of caries if the vitamin is given during the development of the teeth; that a beneficial effect may be obtained if the vitamin is given at a fairly late stage of development; and even after the eruption of the teeth, the onset and spread of caries is delayed."

B. G. BIBBY.

Hair Abnormalities in Cancer (G. Frick and K. Meduna, Wien. klin. Wchnschr., Jan. 17, 1936, p. 76; abstr. Brit. M. J.): The authors believe that a certain amount of diagnostic importance in connection with cancer attaches to peculiarities of the hair. Stumpell, in 1912, stated that cancerous patients, even in old age, seldom showed gray or white hair. Schriddle, in 1922, investigated a large group at necropsy and concluded that all cancer patients displayed scattered hairs, or groups of hairs which were deeply black, thick, limp and lusterless. The authors, in their examinations of 300 patients, found this characteristic type of hair in one fourth the group. Not all of this portion showed evidence of being cancerous, but a history of cancer in the family was usually elicited. The characteristic hairs seemed to appear in early maturity.

J. FRANK HALL.

Prolonged Toxic Effects of Local Anesthetics: Cocaine, Procaine and Allied Drugs; Untoward Effects of Nembutal (F. H. Wetmore, Canadian M. A. J., 34:299 [March] 1936): Patients who are particularly sensitive to local anesthetics are those in general ill health, showing low blood pressure, anemia, defective kidney or liver function, nervousness, allergy or idiosyncrasy. The toxic manifestations may be classified as: (1) cardiovascular: depression of the circulation due to vasomotor dilation, vomiting, faintness, pallor, perspiration, weak pulse, irregular heart action, headache, cyanosis and lower blood pressure; (2) respiratory: sudden air hunger, pneumonia, acute pulmonary edema; (3) nervous: extreme nervousness, spasms or tremors, convulsions, paresthesia. The whole nervous system, including the sympathetic, may be affected. There may be a delayed poisonous action of the drug when injected or simply applied to the mucous tissue. The danger is greater after several doses, even months apart, each dose rendering the person more sensitive to the drug. The author explains in detail two of his own cases. In each case, the patient was sensitive to the local anesthetics. The first case was that of a woman past 50 years of age who had had teeth extracted under local anesthesia (a minimal dose of procaine and epinephrine) on several occasions. Each time, her symptoms were similar. The patient remained in charge of a nurse for seven months. The second case was that of a woman who had the pulp removed from a tooth under cocaine pressure anesthesia. Within half an hour after the cocaine was applied to the tooth, the patient vomited and had intense pain in that side of her face. She soon began to perspire freely, and a week later had severe bowel hemorrhages. Abscesses continued to form around the adjacent teeth, the pulp of which died, evidently as a result of the cocaine anesthesia. Her temperature for several months was subnormal in the mornings, high in midafternoon and normal in the evenings. She became exhausted on the slightest exertion, remaining in this condition for several months. She had, on subsequent occasions, topical anesthetics applied to the mucous membrane of the nose and the gingival tissues, with resultant intense general bodily disturbances. The author also explains the serious toxic effects of the barbituric acid group of drugs. J. FRANK HALL.

MISCELLANY

BOOK REVIEWS

Security Against Sickness. A Study of Health Insurance. By I. S. Falk. 423 pages; price, $4. Published by Doubleday, Doran & Company, Inc., Garden City, N. Y., 1936.

The author of this book has gone into a very exhaustive study of the subject of sickness insurance in most of its manifestations, and in the course of this study has touched briefly on insurance dentistry. If the object of the volume is to further the idea of insurance in these two activities of life, medicine and dentistry, it can hardly be said to have gained its object.

This relates particularly to dentistry. Nearly, if not quite, all of the references to dentistry deal with the agitation following the report of the Committee on the Costs of Medical Care, and it will be recalled that, after due deliberation, the dental profession went on record at the time as in opposition to the idea of insurance dentistry.

As these social and economic questions enter very intimately into professional life, it is well that members of the American Dental Association study them very carefully. The reports from certain European countries where these plans have been tried are not sufficiently encouraging to warrant advocating them here, and while it is well

to know all there is to know about them, it would seem that the more we learn of them, the less they appeal to us as a system to follow in America.

Operative and Interpretive Radiodontia. A Textbook for Students and Practitioners of Dentistry. By Walter S. Thompson, D.D.S., Associate Professor of Radiodontia, College of Dentistry, University of Southern California; Lieutenant, U.S.N.R., Special Service Instructor in Radiodontia; Director of Vocational Training in Operative and of Interpretive Radiodontia, Educational Courses Offered by the Southern California State Dental Association; Consulting Radiodontist, Los Angeles County General Hospital, Cedars of Lebanon Hospital, etc. 355 engravings; 374 pages; price, $7. Published by Lea & Febiger, Philadelphia, Pa., 1936.

This is one of the most attractive and descriptive books on this subject. The technic of the different operations is portrayed in such a manner that it can be followed by any one who gives it the necessary thought.

Radiodontic practice is so widespread that, in these days, few practitioners attempt to get along without it, and the simpler and clearer it is made, the more widely will it be used. To attempt to practice dentistry today without the benefit of roentgen-ray interpretation would be almost on a par with closing one eye.

The type and paper in this book are of a very high order, and the publisher has cooperated in every way with the author in producing a highly pleasing effect. Incidentally, the author has shown rare discrimination and artistic taste in selecting for most of the photographic illustrations the picture of an unusually good looking girl. This should aid in distributing the book.

The Patient and the Weather. By William F. Petersen, M.D., with the assistance of Margaret E. Milliken, S.M., Vol. I, Part 2, Autonomic Integration. 781 pages; price, $9. Published by Edwards Brothers, Inc., Ann Arbor, Mich., 1936.

In the preface to this book, the author argues with some logic that meteorologic environment has more to do with the incidence to disease than we have been giving it credit. For too long a time—decades, claims the author—concentration on the infectious diseases has resulted in neglect of the noninfectious disabilities.

A study of this book must inevitably lead to a broader conception of the life forces, and to the possibility of a very much wider grasp of the nature, the causes and effects of the disease processes that affect humanity. The study of the biologic and pathologic sciences must manifestly accompany any consideration of disease, but, according to this book, there is something more required, and this is found in the meteorologic phenomena that accompany many of our disease manifestations, and that present themselves before our very eyes.

It requires a book of this broad conception to almost literally jerk the reader up standing and make him realize the breadth of his subject. To study even the preface of this volume is to start a man on the way to a rather liberal education on the topics under consideration, and the reviewer would strongly recommend a rather prolonged study of this important and fascinating work. The reader will be well repaid.

NEWS

Dr. Logan Honored: At the recent International Dental Congress held in Vienna, August 2-8, William H. G. Logan, of Chicago, was made president of the International Dental Federation. The next congress will be held in Stockholm in 1941. Forty-seven countries were represented at the recent congress.

DEATHS

Banzet, George T., Chicago, Ill.; American College of Dental Surgery, 1893; died recently at his country home in Serena, Ill., after an illness of three weeks.

Barlow, M. I., Kansas City, Kan.; Western Dental College, 1919; died April 23, of cerebral thrombosis; aged 43. Dr. Barlow was a former president of the Wyandotte County Dental Society and the First District Dental Association. During the World

War, he was a corporal in the Medical Reserve Corps. The widow and two daughters survive. Mrs. Barlow has a dental degree, having graduated (as Ada Bell Shidler) in the same class as her husband.

Bower, A. J., Kendallville, Ind.; Indiana University School of Dentistry, 1907; died suddenly, July 4, from a heart attack; aged 63.

Caine, Earl L., Chicago, Ill.; Chicago College of Dental Surgery, 1920; died recently, from a heart attack; aged 35.

Heffernan, James J., Philadelphia, Pa.; Pennsylvania College of Dental Surgery, 1891; died August 8; aged 70. Dr. Heffernan served ten terms in the state legislature.

Lyons, Henry E., Chicago, Ill.; Northwestern University School of Dentistry, 1907; died recently; aged 67. The widow, three daughters and two sons survive.

O'Bryon, J. W., Lawrence, Mo.; Kansas City Western Dental College, 1892; died July 1.

Rux, B. G., Chicago, Ill.; Chicago College of Dental Surgery; was drowned, August 9, while sailing on Lake Michigan; aged 31.

Sheets, Arthur C., Middletown, Ohio; Ohio College of Dental Surgery, 1907; died recently; aged 50. Dr. Sheets' death occurred very unexpectedly, presumably from a blood clot, after a minor operation. The widow and three children survive.

Sippy, Burne O., La Grange, Ill.; University of Illinois, College of Dentistry, 1917; died July 11; aged 50. Dr. Sippy was a professor of orthodontia at the University of Illinois. He was a former president of the Chicago Association of Orthodontists. The widow and twin sons survive.

Thorson, William J., Chicago, Ill.; Northwestern University School of Dentistry, 1904; died August 2; aged 56. The widow and five daughters survive.

ANNOUNCEMENTS*

CALENDAR OF MEETINGS

American Dental Association, Atlantic City, N. J.

American Society of Orthodontists, Chicago, April 19-22.

Chicago Dental Society, February 15-18.

Greater New York Meeting, December 7-11.

New York Society of Dental History and Culture, New York City, October 15.

Odontological Society of Western Pennsylvania, Pittsburgh, October 27-29.

Texas-Oklahoma-Dallas County, Dallas, August 31-September 4.

Society for the Advancement of General Anesthesia in Dentistry, New York City, third Monday in February, April, October and December.

District of Columbia at George Washington University, Washington, D. C., second and fourth Tuesdays in each month from October to June, inclusive.

Great Lakes Association of Orthodontists, Toronto, Canada, October 19-20.

Montreal Dental Club and Canadian Dental Association, Montreal, October 14-16.

American Association for the Advancement of Science, Subsection on Dentistry, Atlantic City, N. J., December 28.

American Congress of Physical Therapy, New York City, September 7-11.

STATE SOCIETIES

August

Texas, at Dallas (31-September 4)

September

Southern California, at Los Angeles (21-23)

October

Florida, at Orlando (5-7)

*Announcements must be received by the fifth day of the month in order to be published in the forthcoming issue of THE JOURNAL.

November
Puerto Rico, at Mayaguez

April
Alabama, at Mobile (12-14)
Wisconsin, at Milwaukee (19-22)

May
Illinois, at Springfield (11-13)
New York, at New York City (11-14)
Tennessee, at Knoxville (10-13)

June
Maine, at Rangeley (25-26)

STATE BOARDS OF DENTAL EXAMINERS

Indiana, at Indianapolis, October 26. J. M. Hale, Mt. Vernon, Secretary.

Iowa, at Iowa City, December 14-18; May 31-June 4. Hardy F. Pool, Mason City, Secretary.

Minnesota, at Minneapolis, December 11-17. Paul Hagen, Crookston, Secretary.

New Jersey, at Trenton, December 7-12. State Board of Registration and Examination in Dentistry, 148 W. State St., Trenton.

Wisconsin, at Milwaukee, December 14-18. S. F. Donovan, Tomah, Secretary.

ALABAMA DENTAL ASSOCIATION

The 1937 meeting of the Alabama Dental Association will be held at the Battle House Hotel, Mobile, April 12-14.

HUNTER S. ALLEN, *Secretary,*
737 1st National Bank Bldg.,
Birmingham.

MAINE DENTAL SOCIETY

The seventy-second annual meeting of the Maine Dental Society will be held at Rangeley Lake Hotel, Rangeley, June 25-26.

GEORGE A. PHILLIPS, *Secretary.*

TENNESSEE STATE DENTAL ASSOCIATION

The seventieth annual meeting of the Tennessee State Dental Association will be held in Knoxville at the Andrew Johnson Hotel, May 10-13.

E. J. JUSTIS, *Secretary,*
706 Exchange Bldg.,
Memphis.

INDIANA STATE BOARD OF DENTAL EXAMINERS

The Indiana State Board of Dental Examiners will hold its next examination in Indianapolis, beginning October 26. All applications must be in the hands of the secretary not later than ten days before the beginning date of the examinations. For applications and other information, address

J. M. HALE, *Secretary,*
Mt. Vernon.

MINNESOTA STATE BOARD OF DENTAL EXAMINERS

The next examination of the Minnesota Board of Dental Examiners will be held at the College of Dentistry, University of Minnesota, Minneapolis, December 11-17, for granting licenses to practice dentistry and dental hygiene in the state. There is reciprocity with North and South Dakota. All applications must be filed with the secretary at least ten days prior to the date of the examination. Address all communications regarding particulars to

PAUL HAGEN, *Secretary,*
Crookston.

WISCONSIN STATE BOARD OF DENTAL EXAMINERS

The next examination of the Wisconsin Board of Dental Examiners will be held at Marquette University, Milwaukee, December 14-18. Applications must be in the secretary's office ten days before the examination. For further information, address

S. F. DONOVAN, *Secretary,*
Tomah.

GREATER NEW YORK DECEMBER MEETING

The Twelfth Greater New York December Meeting will be held December 7-11 at the Hotel Pennsylvania, New York City.

GEORGE C. DOUGLASS,
Room 106A,
Hotel Pennsylvania,
New York City.

AMERICAN SOCIETY OF ORTHODONTISTS

(Change of Dates)

The Thirty-Fifth Annual Meeting of the American Society of Orthodontists will be held in Chicago, April 19-22, at the Edgewater Beach Hotel.

CLAUDE R. WOOD, *Secretary,*
608 Medical Arts Bldg.,
Knoxville, Tenn.

ODONTOLOGICAL SOCIETY OF WESTERN PENNSYLVANIA

The Fifty-Fifth Annual Meeting of the Odontological Society of Western Pennsylvania will be held in Hotel William Penn, Pittsburgh, October 27-29. All A.D.A. members are invited.

LEO SHONFIELD, *President,*
Jenkins Bldg.,
Pittsburgh.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, SUBSECTION ON DENTISTRY

The Subsection on Dentistry of the American Association for the Advancement of Science will hold a morning and an afternoon session at Haddon Hall, December 28, as part of the association's winter meeting at Atlantic City, N. J. All dentists, physicians and laymen are welcome. The detailed program will be announced later. Address inquiries to

J. L. T. APPLETON, D.D.S.,
4001 Spruce St.,
Philadelphia, Pa.

EXAMINATION FOR APPOINTMENT IN THE DENTAL CORPS OF THE NAVY

A competitive examination to select not more than six for appointment in the Dental Corps of the Navy will be held November 2 at the Naval Dental School, Washington, D. C., Naval Training Station, Great Lakes, Ill., and Naval Training Station, San Diego, Calif. A candidate for appointment in the Dental Corps must be a citizen of the United States and must be between 21 and 32 years of age at the time of appointment, a graduate of a standard dental college, of good moral character and of unquestionable professional repute. Credentials relative to character, citizenship, date of birth and education must be submitted and approved before an applicant can be authorized to appear for examination. A circular which contains full information relative to the Dental Corps and describes the method of making application for appointment can be obtained from the Bureau of Medicine and Surgery, Navy Department, Washington, D. C.

P. S. ROSSITER, *Surgeon General,*
U. S. Navy.

BRONX HOSPITAL EXTERNESHIPS

The Dental Department of the Bronx Hospital offers a number of externeships to recent graduates in dentistry, in the following branches: (1) oral surgery and anesthesia; (2) surgical treatment of pyorrhea; (3) orthodontia; (4) root-canal therapy; (5) operative dentistry. Those offering satisfactory evidence as to their interest in the clinical study of dental surgery as a health measure will receive consideration. Applications should be addressed to the Dental Department, Bronx Hospital, Fulton Ave. at 169th St., Bronx, New York City.

REPRINT OF PAPER ON PHYSICAL PROPERTIES OF DENTAL MATERIALS

The Bureau of Standards has arranged to reprint Research Paper No. 32, "Physical Properties of Dental Materials," a summary of work on dental gold alloys and a few accessory materials covering the research up to 1936. The price is 35 cents a copy (stamps not accepted). On orders for 100 copies or more, the discount is 25 per cent. All orders should be sent to the Superintendent of Documents, Washington, D. C.

LYMAN J. BRIGGS, *Director,*
National Bureau of Standards.

PER CAPITA CONTRIBUTION OF STATES TO RELIEF FUND

The total amount contributed to the Relief Fund for the year ending June 30, 1936, was $18,389.22. This is an average of 47.84 cents per member.

The following is the per capita contribution from each state.

Alabama	$ .40	New Hampshire	$ .54
Arizona	.44	New Jersey	.46
Arkansas	.14	New Mexico	.59
Army	.38	New York	.87
California	.38	North Carolina	.24
Colorado	.29	North Dakota	.44
Connecticut	.80	Navy	.25
Delaware	.74	Ohio	.33
District of Columbia	1.46	Oklahoma	.20
Florida	.74	Oregon	.38
Foreign	1.95	Pennsylvania	.43
Georgia	.26	Philippine Islands	2.00
Idaho	.47	Puerto Rico	.19
Illinois	.41	Rhode Island	.52
Indiana	.30	South Carolina	.19
Iowa	.34	South Dakota	.26
Hawaii	.45	Southern California	.34
Kansas	.46	Tennessee	.34
Kentucky	.52	Texas	.63
Louisiana	.32	Utah	.83
Maine	.46	Vermont	.30
Maryland	.53	Virginia	.50
Massachusetts	.38	Washington	.31
Michigan	.28	West Virginia	.50
Minnesota	.38	Wyoming	.73
Mississippi	.22	Wisconsin	.32
Missouri	1.13	U. S. Public Health Service	.13
Montana	.48	U. S. Veterans Administration	.17
Nebraska	.25	Panama Canal Zone	.45
Nevada	.32		

It is interesting to note that of the fifty-nine component organizations listed, nineteen have contributed more than the average and forty less than the average. The lowest per capita is 13 cents and the highest $2. There can be no logical reason for such a great variation as this.

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